Industry and Power

November 1953

Combustion Control
Small steam plants improve efficiency with modern instruments and controls 67

Fuel Selection
Caterpillar's Peoria Plant is making use of a wide variety of fuels for heat treating 72

Chrysler's Utility Plant
Utilities are now centralized in Trenton Engine Plant 76

Storage Batteries
Widely used in industry, storage batteries are a mystery to many engineers 82

Fork Truck Stability
High stacking practices mean new hazards for fork trucks ..85

Air Conditioning
Scale and corrosion cannot be tolerated in a well maintained air conditioning system 88

Insulation
Techniques used in insulating Jersey Central's E. H. Werner steam station 90

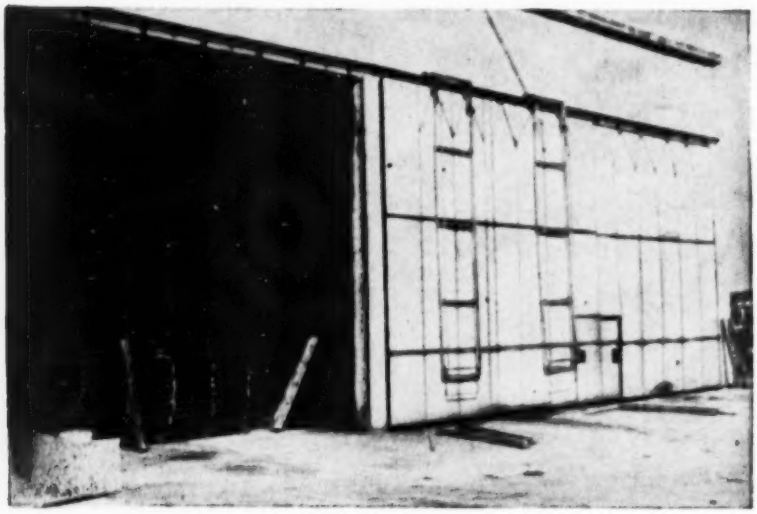
Lighting Maintenance
New ideas and better equipment make industrial lighting maintenance easy 93

for engineers and executives responsible for

— engineered plant facilities

"Best" New Dry Kilns Work Better with Armstrong Unit Trapping

4 Traps Increase Capacity 8%



▲ One Armstrong No. 215 inverted bucket steam trap is used on each of the four dry kiln coils at Wells-Oates Lumber Co., New Bern, N. C.

◀ The time cycle on this lumber dry kiln was reduced from 72 to 66 hours by Armstrong Unit Trapping.

OFTEN a large capital investment in steam heated equipment is not utilized fully simply through failure to drain condensate and air efficiently. Here is a typical case:

Wells-Oates Lumber Co., New Bern, N. C., recently made one of the finest and most modern dry kiln installations possible. And it worked fine. But, it works better now, thanks to the installation of an individual Armstrong steam trap on each of the four steam coils in the kiln. The kiln cycle time has been reduced from 72 hours to 66 hours. The capacity has thereby been increased over 8% by an investment in traps of only a little over $200.

The trap installation was made upon the recommendation of DeWitt H. Skinner of Allan T. Shepherd Co., the local Armstrong Representative. The reason behind his recommendation made sense to the Wells-Oates people —*"with one trap on each of the four coils of the kiln, all coils would be properly purged of condensate and air and it would, therefore be impossible for one coil to influence the operation of another coil." The results proved the point.*

Your local Armstrong Representative may be able to show you how to get more out of your steam heated equipment. Remember, he sells a product that is *guaranted to satisfy. Call him or write:*

You always get more out of equipment when you use Armstrong "Unit Trapping"

ARMSTRONG MACHINE WORKS

820 Maple Street, • Three Rivers, Michigan

SEND FOR 44-PAGE STEAM TRAP BOOK a Catalog and Educational Handbook on Condensate Drainage

Attach to your Company Letterhead and Mail Today.

ARMSTRONG MACHINE WORKS
820 Maple Street, Three Rivers, Michigan
Please send me a Steam Trap Book.

Name .....

Title .....

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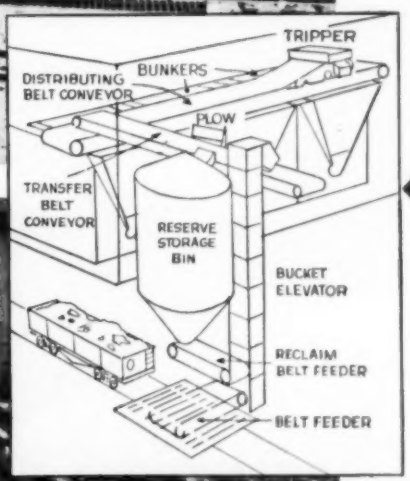
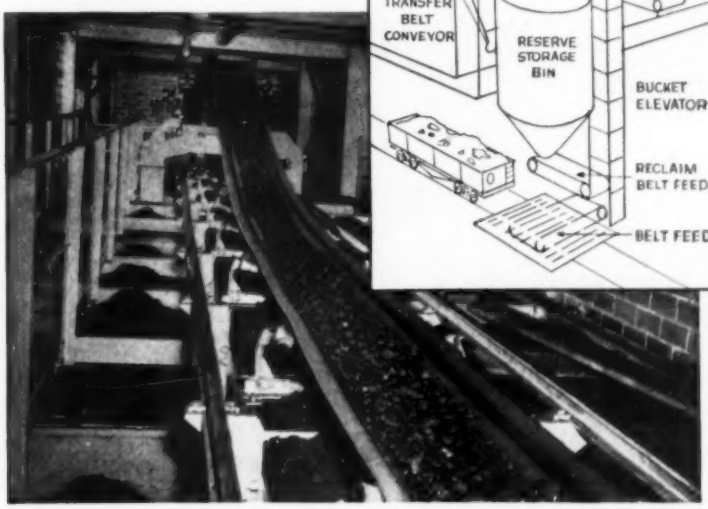
Maximum power plant efficiency starts with low-cost coal handling





At A. V. Roe Canada Limited, Malton, Ont., one of Canada's biggest industrial plants, coal moves from track hopper on belt feeder to bucket elevator to transfer belt conveyor. Manually operated plow diverts coal from transfer belt conveyor to reserve storage or allows it to be carried to distributing belt conveyor where tripper discharges it to various bunkers. A second belt feeder reclaims coal from reserve storage bin to bucket elevator.

Put LINK-BELT's broad engineering experience plus quality equipment to work for you

As boilers and generating equipment approach their efficiency limits, the one large-scale method to reduce cost per kwh is improved coal handling. That's why Link-Belt's broad engineering experience and complete line of equipment are so important.

Whether your requirements are large or small, Link-Belt will design and build a coal handling system to give you the highest efficiency and greatest economy. Our engineers can choose from all types and sizes of equipment for unloading, storing, handling and weighing your coal. And Link-Belt will assume complete responsibility for the entire installation — from planning to erection.

You can see the latest in equipment and system layouts in Link-Belt Book 2410. Ask the engineer in the Link-Belt office near you for a copy. He'll also be glad to show you how this modern planning can cut costs on your particular handling problem.

LINK-BELT

COAL HANDLING EQUIPMENT

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

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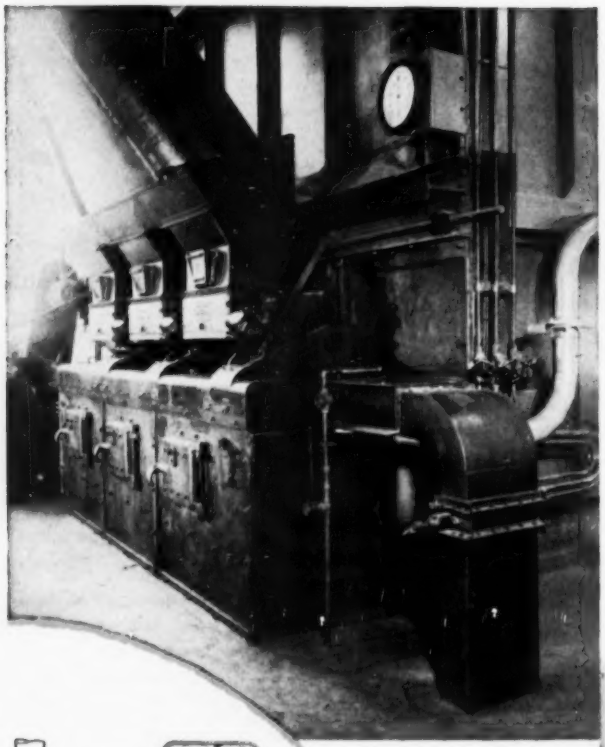
24 hours a day 7 days a week

Detroit RotoGrate Stoker in Ladish Malting Co.



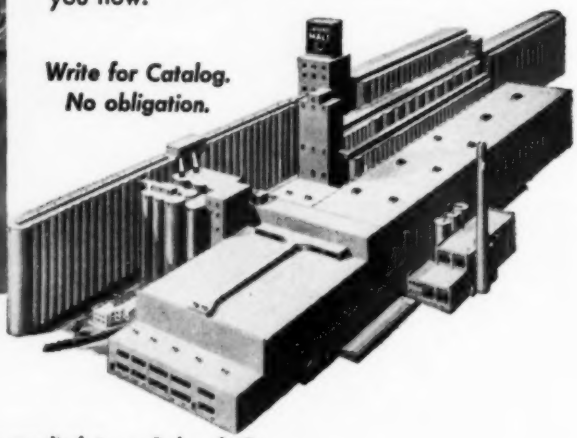
Exceptional reliability and very high availability are an utmost necessity in malting plant operation.

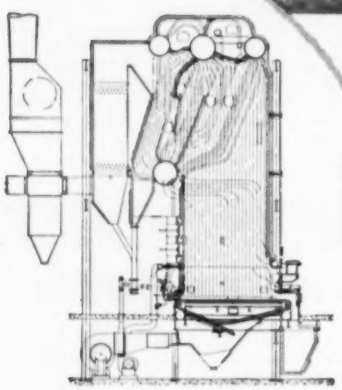
Enormous quantities of steam are needed in the Jefferson Junction, Wisconsin, plant of the Ladish Malting Co. for power and process. Ten million bushels of malt are manufactured annually. Steam generating equipment operates 24 hours a day and 7 days a week.

Difficult firing problems are always best solved by the use of Detroit RotoGrate Stokers.

Why not let them start saving money for you now.

Write for Catalog. No obligation.





Detroit RotoGrate Stoker applied to a Babcock & Wilcox—4 drum Stirling Boiler with Superheater and Economizer Capacity 75,000 pounds. 410 psi 600° F.

DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.

WORKS IN MONROE, MICH.

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VOLUME 65 **November 1953** NUMBER 5

FEATURE ARTICLES

Instruments and Controls for Small Steam Plants 67
Wm. H. Pugsley, Vice President, Field Research, The Hays Corp.

Fuel Selection for Heat Treating at Caterpillar 72
Glen C. Riegel, Chief Metallurgist, and Thomas Spencer, Ass't Metallurgist, Caterpillar Tractor Company

Chrysler Centralizes Plant Utilities 76
Staff Report

Understanding Storage Batteries 82
K. A. Vaughan, Manager, Field Engineering, Gould-National Batteries, Inc.

High Stacking Affects Fork Truck Stability 85
Harold Milz, Chief Engineer, Mercury Manufacturing Company

Water in Air Conditioning Systems 88
Charles Bird, General Manager, The Bird-Archer Company

Engineered Insulation Cuts Heat Loss 90
G. H. Ritter, Production Dept., Jersey Central Power & Light Co.

Make Lighting Maintenance Easy 93
Morgan Christensen, Lamp Division, General Electric Company

Longer Life for Pump Plungers 97

Better Service From Roller Chains 99

Cover Photo — Caterpillar Tractor Company
See story page 72

DEPARTMENTS

Acorns 6
New Equipment 8
Letters From Readers 34
New Bulletins 36
Handbook 99
Spot News 102
Names Make News 110
Readers' Guide 115
Book Reviews 128
Meetings 132
Available Reprints 133
Classified Advertising 133
Advertisers' Index 134

Established May 1920

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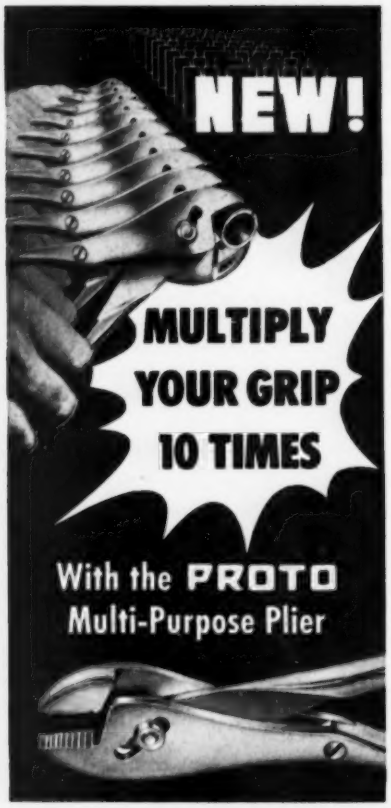

Try the sensational PROTO No. 234 Multi-Purpose Plier and you will want one for sure! Using a patented three-piece compound leverage design, pressure applied to the handles is increased *ten times* at the jaws! This plier is actually "a chest of tools in one." It securely holds square, round and even tapered objects. To make your work easier, buy one today!

New—the No. 243 Multiple-Groove Joint Plier, which Handles Hundreds of Jobs. Five-Position, Tongue-and-Groove Joint Prevents Slippage.

Choose PROTO for Your Other Plier Needs

In the extensive PROTO line, you will find the right size and style of plier for almost every job. And remember that every one has true *professional quality*. Send 10¢ for complete 68-page catalog to

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5384

PROTO TOOLS
Professional Quality

Eastern Factory: Jamestown, N.Y.
Canadian Factory: London, Ont.

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acorns

. . . recently announced . . . worth watching

Project Tinkertoy

• An automatic production line for the manufacture of electronic products has been announced by the National Bureau of Standards. Working on the problem since 1950 under the project code name "Project Tinkertoy," the NBS has also developed a novel system of components design which makes the automatic production possible. Conductors, resistors, capacitors, and other circuit components are put on uniform steatite wafers. The wafers are then stacked and interconnected by wires which run up and down the stack like spars. Automatic inspection machines check the stacks along the production line.

Silicone Greases Improved

• Diesters of dicarboxylic acids have been found to be miscible with silicone fluids, giving rise to new greases of improved characteristics. Some mixtures have been thickened with lithium stearate. The greases with these additives have been found extremely heat and oxidation stable.

German Casting Machine

• A permanent mold casting machine for casting aluminum cylinder heads has been disassembled and studied. Information has just been released on the German machine's construction, an evaluation of the castings it makes, and production advantages it offers.

Beryllium Field Expands

• The industrial range of beryllium-copper alloys is expected to expand greatly due to the recently announced advances in beryllium technology. There is Beryldur—a new alloy combining properties of high strength and high conductivity. A high purity beryllium oxide has been announced which is suitable for refractory shapes and ceramic bodies; it also holds promise as a catalytic agent. A ferro-beryllium alloy is designed for corrosion-resistant casting applications.

Silicone Walls

• Fire walls among other structural elements may soon be made of foamed silicone resins. The resins can be blown-in right in position, forming uniform closed cell structures which weigh anywhere from 8 to 24 pounds per cubic foot. The foam structures retain their compressive strength at high temperatures. Extended exposures to temperatures of 700 F produce only slight dimensional changes. One side of a half-inch thick sheet can be heated red hot, and only a slight warmth is felt on the opposite side.

Transistor Companion

• A companion component for transistors—a tiny tantalum capacitor—has been announced. Part of the steady march toward smaller electronic assemblies, the new capacitor is about the size of the head on a wooden match. The device is expected to help open the door for commercial applications of miniature electronic devices.

New Adhesive

• The widening usage of Teflon (polytetraflouroethelene) in industry brings up problems of binding the material to other substances. Test quantities of a suitable adhesive have just been announced. It is a pressure-sensitive adhesive which has a direct strength of 12 to 15 pounds per square inch when binding Teflon to Teflon or Teflon to stainless steel.

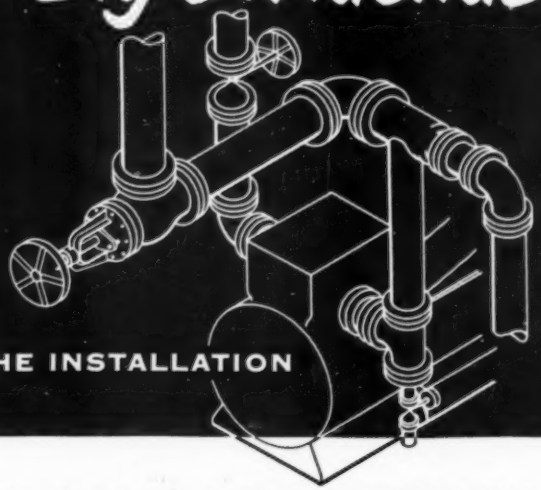
Study Magnetics

• A program is underway to investigate the basic nature of magnetism, possible new alloys, metallurgical factors, and theories of magnetic phenomena. The first work will delve into permanent magnets. Ultimately, it is expected that improved devices will come from better understandings of magnetics and then development of utilization devices will be expanded.

Bigger Loads

• Development has been announced of a load calibrating device with a capacity ranging up to 6000 tons. Four compression dynamometers combine to give this capacity. It is estimated that the new device can calibrate a 10,000,000-pound testing machine in a fourth of the time that older, more complex strain gage devices required to calibrate a 2,500,000-pound machine.

Thrifty Valve Buying in 1918 Still Paying Big Dividends



THE INSTALLATION

At the American Crystal Sugar Company's Rocky Ford, Colorado, mill where Crane 12-inch iron body angle valves control carbon dioxide to pumps supplying the gas for carbonation process.

THE CASE HISTORY

This CO_2 service requires valves of utmost dependability to protect process and equipment from damage. In the event of malfunction or failure of pumps, the valves must assure positive closure every time.

That's precisely the quality of performance Crane No. 353 valves have given in this service for more than 35 years. The mill's long inactivity between 75-day production campaigns hasn't made the job easier. Yet, these valves have never been out of the lines for repairs; they've remained on the job since 1918 with only routine maintenance.

Valves that set performance records like this aren't bought on price alone—it's quality that counts most. That's thrifty buying—still the only way of getting the best value.

VALVE SERVICE RATINGS

SUITABILITY: *Never failed in 35 years*

FEATURES: *Simplified design—easy to service*

MAINTENANCE COST: *None—Routine care only*

SERVICE LIFE: *Installed 1918—still O.K.*

OPERATING RESULTS: *Dependable CO_2 control*

AVAILABILITY: *Crane catalog item—No. 353*

THE VALVE

You can see the ruggedness and serviceability of No. 353 angle valves, but it's what's inside that counts most in their better performance. Choose these valves from the complete family of Crane 125-pound iron body globes and angles. It gives you the widest selection of patterns and types for steam, water, oil, and gas. See your Crane Catalog or your Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES · FITTINGS · PIPE · PLUMBING · HEATING

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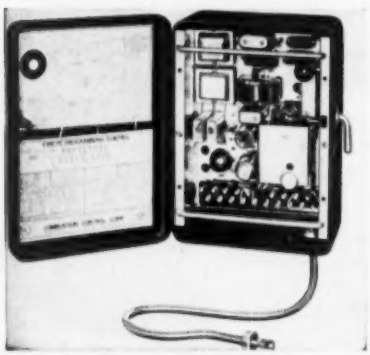
new equipment

. . . new developments

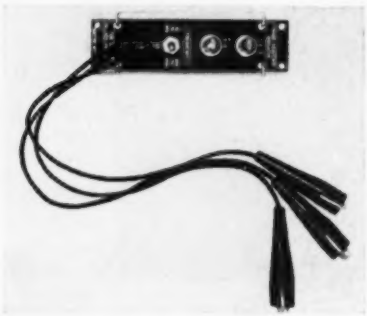
Variable speed drive has 50 percent more power

L10 Improved Model 28 variable speed drive manufactured by Graham Transmissions, Inc. is said to have 50 percent more power than previous models of approximately the same size. It incorporates a 2-piece housing with integral base, improved control that provides linearity—equal changes in speed for equal changes in dial setting—and cooler, quieter operation. It is available with a wide variety of built-in reducer or step-up gearboxes. The transmission can also be had with built-in motors of all types (including explosionproof) and with a variety of controls including remote electrical, pneumatic, and remote mechanical.



Control guards against flame failure explosions

L11 Combustion Control Corp. announces the Fireye Programming Control for commercial-industrial gas, oil, or combination gas-oil burners. Employing the flame-sensitive Firetron Cell, it shuts off fuel in 2 to 4 sec after a burner flame goes out. The control provides a single standard package unit with complete automatic startup, operating, and shutdown control for any type of burner and a selection of programming times for 3 types of ignition operation to comply with Factory Mutual Laboratories' requirements. An installation bulletin is available.

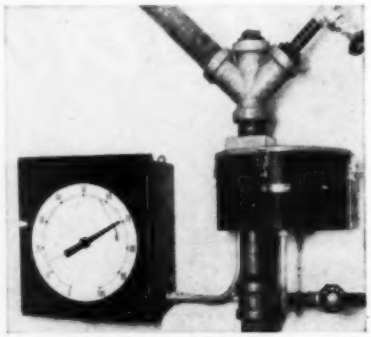


Phase sequence indicator designed to save time

L12 Intended as a time saving tool for maintenance men and engineers, a simple and compact phase sequence indicator measuring 7 x 2½ x 2½ in. and weighing approximately 1½ lb has been developed by the United Manufacturing Co. It can be used to determine polyphase motor rotation and transformer and alternator connections on 110, 220, 440-v lines without modification or the use of external resistors. The instrument will cover a frequency range of 30 to 300 cycles and 300 to 1000 cycles at the flip of a switch.

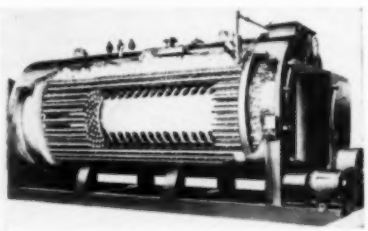
Non-flammable hydraulic fluid is non-corrosive

L13 Houghto-Safe, non-flammable, non-corrosive, hydraulic fluid developed by E. F. Houghton & Co., is said to combine maximum fire resistance with top hydraulic efficiency. Laboratory and field tests show that it can be used efficiently at 1000 psi pump pressure. Film strength tests indicate that it will carry 2½ times the load of conventional (petroleum) hydraulic oil of similar viscosity. In addition, the liquid will not freeze and will not separate or break down under increased pressures.



Turbidimeter measures and records suspended particles

L14 Developed for use in any process where turbidity is a significant factor, the General Electric Company's recording turbidimeter can be used with an audible or visible alarm. The instrument continuously and automatically measures, and permanently records the number of particles suspended in liquids. With maximum operating pressure of 100 psi inside the sampling head, it has an accuracy of plus or minus 5 percent of full scale and a precision of plus or minus 3 percent of full scale. Range is adjustable from 0 to 25, to 0 to 10,000 ppm (silica scale). Sampling head requires 175 w, 115 v ac, recorder 55 w at 115 v ac, 60 cycles.

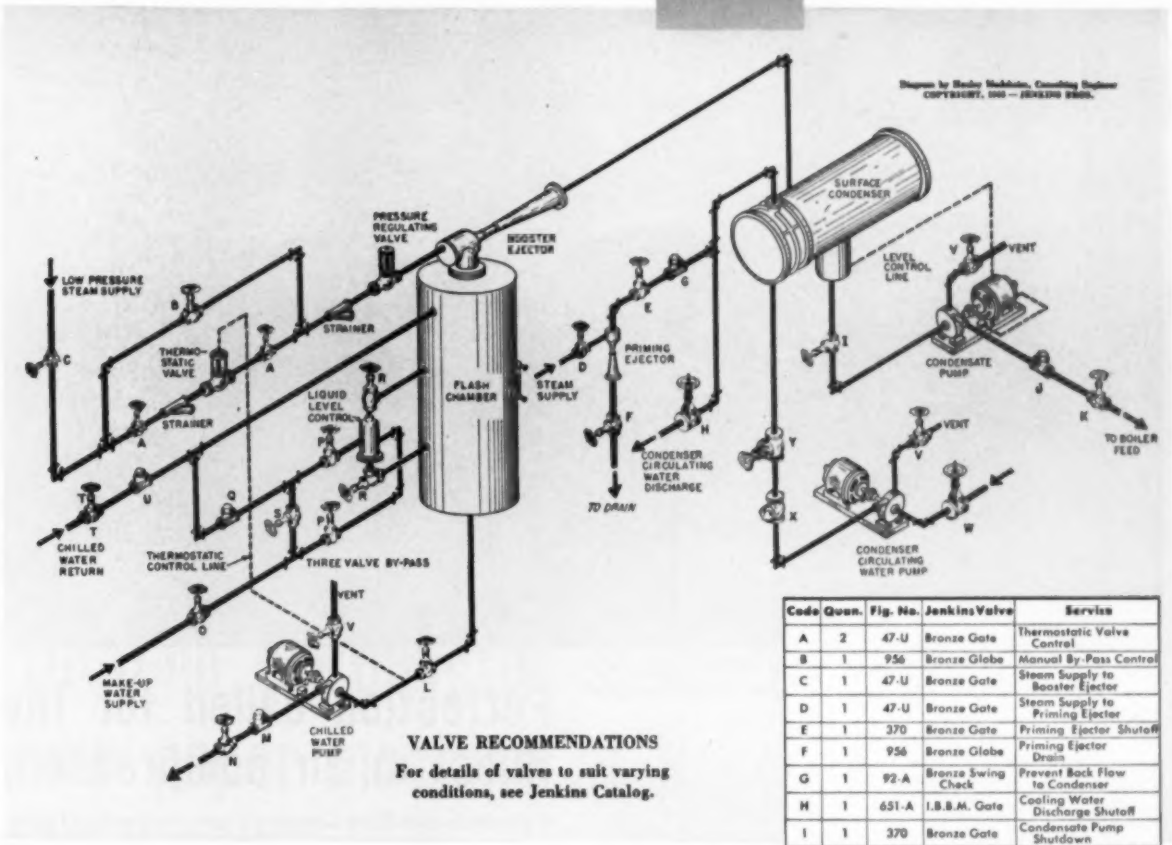


Two-pass boiler design eliminates refractory baffle

L15 Continental Boiler Division of Boiler Engineering and Supply Co., Inc., reports a simplification and improvement in their boiler construction. The Continental, an automatic steam generator, 20 to 500 hp, features a two-pass design which eliminates the need for refractory baffles or partition in front or at the rear. This design is

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card between pages 34 & 35.

JENKINS PRACTICAL PIPING LAYOUTS 69



VALVE RECOMMENDATIONS

For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	Fig. No.	Jenkins Valve	Service
A	2	47-U	Bronze Gate	Thermostatic Valve Control
B	1	956	Bronze Globe	Manual By-Pass Control
C	1	47-U	Bronze Gate	Steam Supply to Booster Ejector
D	1	47-U	Bronze Gate	Steam Supply to Priming Ejector
E	1	370	Bronze Gate	Priming Ejector Shutoff
F	1	956	Bronze Globe	Priming Ejector Drain
G	1	92-A	Bronze Swing Check	Prevent Back Flow to Condenser
H	1	651-A	I.B.B.M. Gate	Cooling Water Discharge Shutoff
I	1	370	Bronze Gate	Condensate Pump Shutdown
J	1	92-A	Bronze Swing Check	Prevent Backflow through Condensate Pump
K	1	106-A	Bronze Globe	Condensate Pump Control
L	1	370	Bronze Gate	Chilled Water Pump Shutdown
M	1	92-A	Bronze Swing Check	Prevent Back Flow Through Pump
N	1	106-A	Bronze Globe	Chilled Water Pump Control
O	1	106-A	Bronze Globe	Make-up Water Control
P	2	370	Bronze Gate	Automatic Valve By-Pass
Q	1	92-A	Bronze Swing Check	Prevent Backflow from Chamber
R	2	108-A	Bronze Angle	Level Control Shutoff
S	1	106-A	Bronze Globe	Manual By-Pass Control
T	1	106-A	Bronze Globe	Chilled Water Control
U	1	92-A	Bronze Swing Check	Prevent Backflow Chilled Water Lines
V	1	106-A	Bronze Globe	Pump Vent
W	1	651-A	I.B.B.M. Gate	Condensing Water Pump Shutdown
X	1	624	I.B.B.M. Swing Check	Prevent Backflow to Pump
Y	1	613	I.B.B.M. Globe	Pump Control

How to plan a

STEAM JET REFRIGERATION SYSTEM

The use of steam for air conditioning has increased steadily during the past few years, principally because of the low cost of steam. In plants generating their own steam, demands on the boiler plant are greatly reduced during the summer months, while plants having to purchase district steam usually benefit by reduced summer rates.

In the steam jet system shown, water returned from the chilled water coils of the air conditioning system enters the flash chamber which is maintained at a low pressure by the booster ejector. Here the water is cooled to a temperature corresponding to the boiling point at the reduced pressure. Heat is removed by the flashing of a portion of the returned water to steam which is removed by the ejector.

The booster ejector used in this system requires either a barometric or surface condenser. Pump drives may be either electric or steam turbine, depending upon local operating costs and the size of the installation.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

• •

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 69.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864
JENKINS
Jenkins Bros.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE
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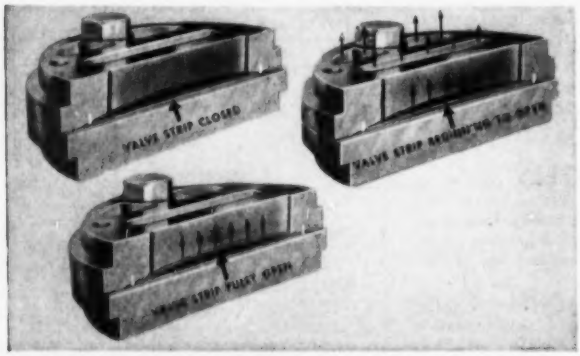
PERFECTION STOVE'S ULTRA-MODERN POWER PLANT is equipped with two Worthington DC-2 air compressors, each with a capacity of 1000 cfm.



QUIET-OPERATING WORTHINGTON FEATHER* VALVE is made up of a series of thin flexible strips of ribbon steel, held in position over rectangular openings by curved milled guards. The valve strips lift and flex uniformly against the curved guards. In addition to quiet operation, the absence of impact results in long valve life and low maintenance costs.

Perfection called for the finest in air compressors

• The Perfection Stove Company's new Ivanhoe Road power house in Cleveland has received national recognition as a leading example of modern, medium-size power plant design.

Every piece of equipment in this million-dollar plant had to meet the rigid specifications of Perfection's engineers. That's why, when it came time to supply compressed air for general plant use, two Worthington DC-2 horizontal air compressors were selected.

By installing these modern Worthington compressors, Perfection engineers made sure they would get lowest-cost compressed air and longest compressor life. The exclusive Worthington Feather* Valve—the lightest, tightest, most efficient valve made—is largely responsible for that.

Take a tip from Perfection Stove and find out for yourself about the Worthington line of air compressors. Write to Worthington Corporation, Compressor Division, Section K.3.7, Buffalo, N. Y. **Reg. U. S. Pat. Off.* K.3.7

WORTHINGTON

Only Worthington Compressors give you Feather Valve Performance

Y-Types • Balanced Angle • Horizontal • Portable • Radial • Gas Engine Compressors

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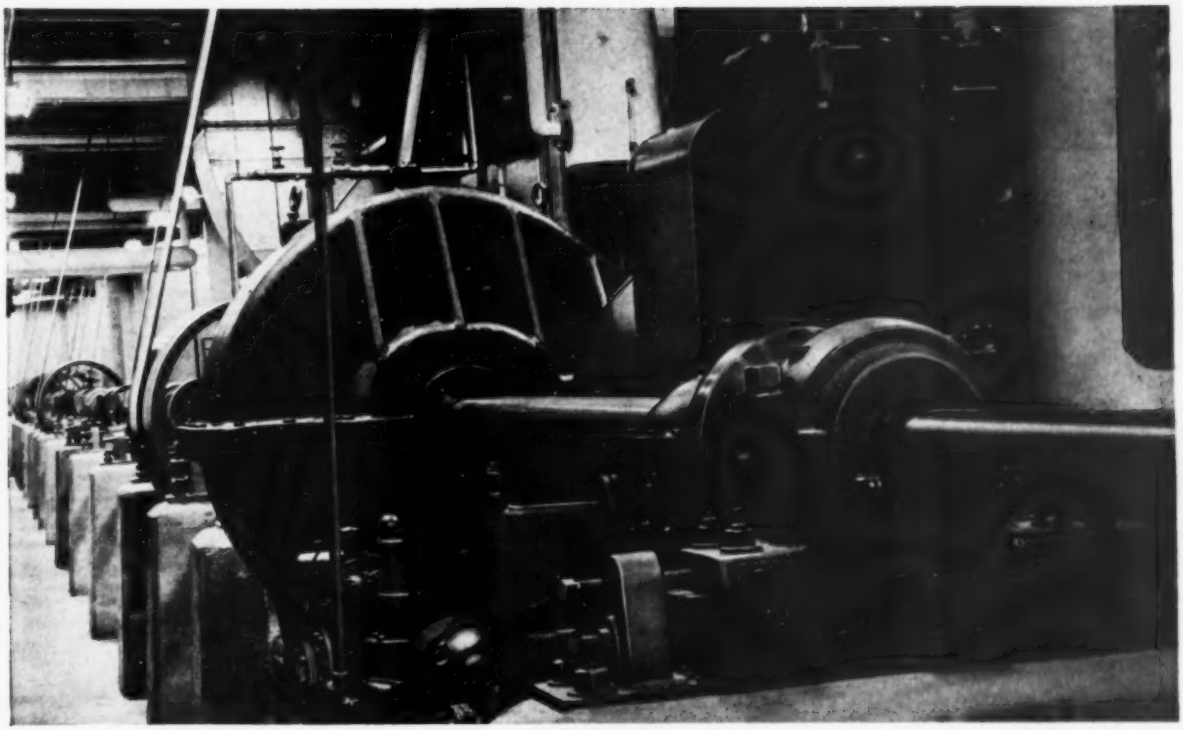
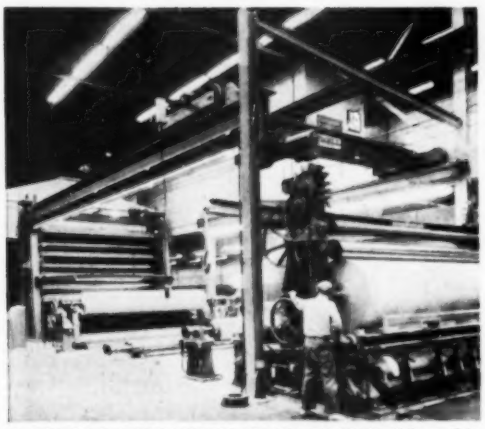


SMOOTH, STEADY SPEEDS are assured by this 1000-hp Worthington geared turbine driving the line shaft of Nekoosa-Edwards' new paper machine.

1000-hp Worthington steam turbine drives new paper machine at Nekoosa-Edwards



A SINGLE WORTHINGTON STEAM TURBINE drives this huge paper machine at Nekoosa-Edwards.

• Making high-grade specialty and printing papers is exacting precision work—with smooth, steady paper-machine speed the main requirement. That's why, when the Nekoosa-Edwards Paper Co., Nekoosa, Wisc., installed their new Puseyjones 180" Fourdrinier recently, a Worthington 1000-hp steam turbine and reduction gear were selected to drive the lineshaft.

The turbine's sensitive governor holds speed to within 1/10 of 1% above or below the governor setting, regardless of normal steam or load changes. Speed range is from 200-1200 ft. per minute, suitable for every paper run. Remote push-button control saves labor, minimizes routine attention.

The new Worthington turbine has fully automatic nozzle valve control that assures economical operation at all times. And there's plenty of reserve power in the turbine to handle future additional load requirements. No steam is wasted, either; 50 psi exhaust goes to the plant's process equipment.

Driving paper machines is only one of the many applications of the versatile steam turbine. Get the facts on the way a Worthington steam turbine can solve your drive problems, too. Write to Worthington Corporation, Steam Turbine Division, Section T.3.9, Wellsville, New York.

T.3.9

WORTHINGTON

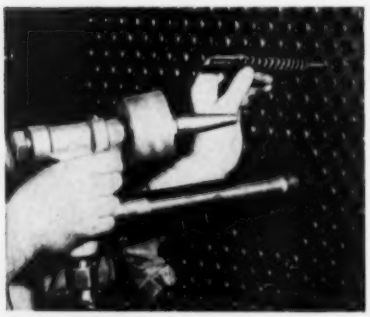
Single-stage turbines **Multi-stage turbines** **Turbine-generator sets** **Feed water heaters** **Boiler feed pumps** **Surface condensers**

Circle 507 on Reply Card for more data

new equipment

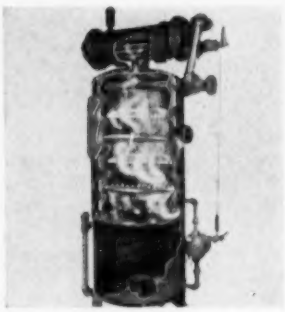
—Starts on page 8

reported to make possible easy and full access to all fire surfaces. Under normal operating conditions the stack temperature is guaranteed not to exceed 125 F above saturated steam temperature at the operating pressure.



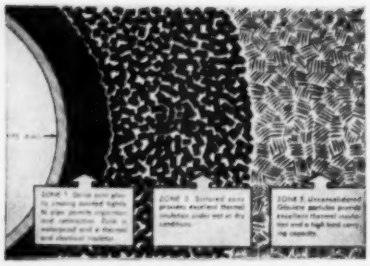
Jiffy Gun shoots brushes through condenser tubes

L16 A condenser tube cleaning "team" consisting of spirally wound nylon brushes and an improved aluminum Jiffy Gun have been developed by The Elliott Co. The spiral design of the nylon brushes gives them a spinning, scouring motion which, together with the flushing action of the water from the gun, quickly removes sludge and other soft deposits from small tubes as in condensers and heat exchangers.



Feed-water heaters require minimum of cleaning

L17 Spray type deaerating feedwater heaters that operate silently and require a minimum of cleaning and maintenance have been developed by Stickle Steam Specialties Co. The only part that requires cleaning is the spray distributor which is easily removed without breaking any piping connections. The heaters are designed for use by power plants operating with a boiler pressure of 75 lb or more. Capacities range from 3000 to 300,000 lb of preheated feedwater per hour. Any storage capacity may be incorporated.

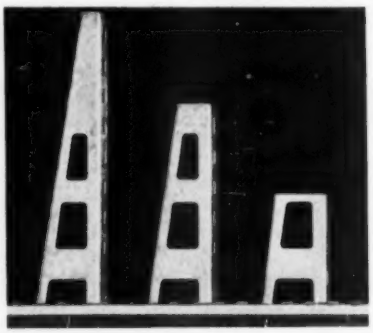


Underground pipe insulated and protected by mineral product

L18 A triple-zone of protection for hot underground pipes is provided by Gilsulate, a gilsonite mineral product, developed by American Gilsonite Co. It is said to assure permanent protection against commonly-encountered corrosive factors and to allow burial of hot and cold pipe in the same ditch because of its high insulating efficiency. When poured around the hot pipe, the material melts and fuses to the pipe to form a dense, semi-plastic coating as shown in the illustration.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.

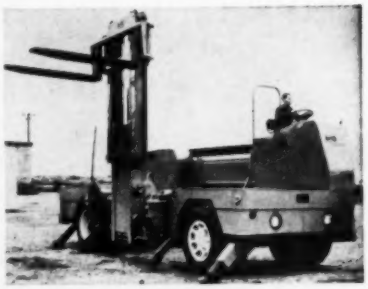


No fasteners required for one-piece bracket

L19 The Rakit Corp. announces the development of a one-piece bracket which can be placed securely into slotted vertical channel pieces by just a twist of the wrist. No nuts, bolts, or other fasteners are required. The bracket is available in 3, 7, 13, and 19 in. lengths. Greater lengths can be obtained by the use of extenders. Literature is available.

Submerged operation pump used for dangerous fluids

L20 Designed especially for handling dangerous fluids, is a pump announced by Milton Roy Co. Because the entire liquid end assembly is submerged in a sump with only the driver and discharge piping exposed, problems of stuffing box leakage are eliminated. Basically a variation of the MiniPump, it will operate in approximately the same range: capacities up to 3200 milliliters per hour, pressures up to 1000 psi.



Side-loading fork truck has greater speed

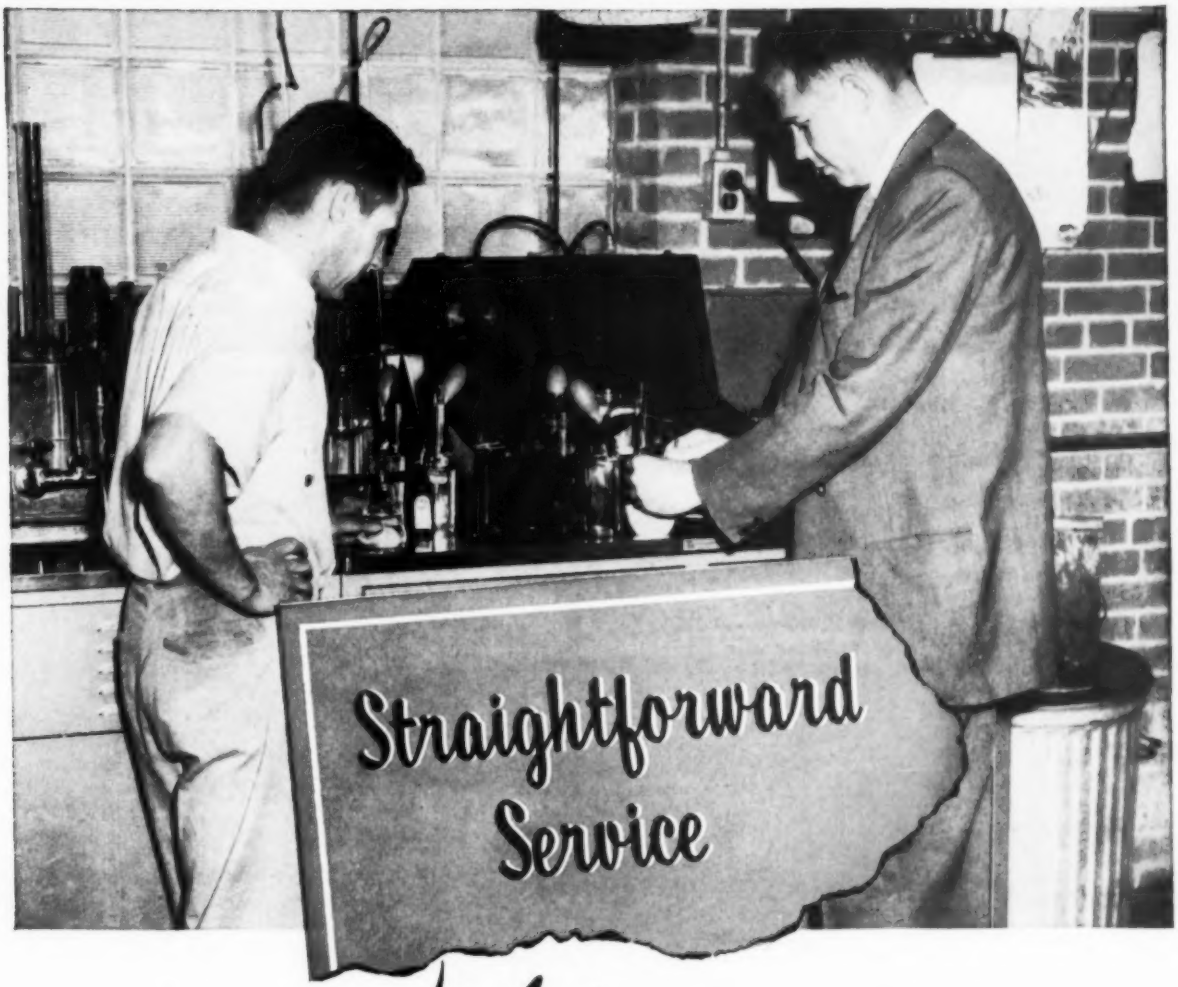
L21 Development of a 30,000 lb capacity Traveloader, combination side-loading fork truck and load carrier, designed to stack or haul long, bulky loads such as lumber or steel stock in a 12-ft aisle, has been announced by the Baker-Raulang Co. One major advantage of the truck, according to the manufacturer, lies in the fact that the new unit's high speed—up to 30 mph—and over-the-road travel ability make it much more useful as a long-haul carrier than ordinary forklift trucks.

Chemical dissolves ice and snow faster than rock salt

L22 To answer the need for a safe, efficient de-icer, Colonial Refining & Chemical Co. is now marketing Kleen-Sweep, which is said to clear ice off walks, steps, driveways, and ramps 36 times faster than rock salt. It can also be used to thaw out frozen gutters, pipes, and sewers. It generates enough heat to prevent ice from forming after another snow fall, the following day. The chemical is said to leave no whitish deposit to be tracked into offices and buildings, and to be harmless to cement, metal, tires, shoes, and grass.

Handy clip pencil incorporates slide-rule scales

L23 Designed for the busy engineer, estimator, or contractor, one handy instrument, the slide-rule pencil, calculates, magnifies, and writes in two colors. Designed by the Device Development Co., it incorporates a fine print magnifier, depth gage, detachable ruling edge, and a plain and enlarging cursor for the slide rule's 9 scales. Only 6½ in. long, its scales are permanently marked by a debossing process.



from Your *Nalco*® REPRESENTATIVE

● Nalco Representatives make friends and permanent Nalco System users with a simple formula: honest water treatment service.

You can ask your Nalco Representative questions and get straightforward answers . . . And if you stump him, he—and you—can put the whole Nalco Laboratories' and Service staffs to work on a plain-language plan of action to get you better water treatment results, most economically.

If you are not already getting the security from water treatment troubles that regular calls from your Nalco Representative bring, call or write today for prompt action.

Nalco WATER TECHS

A paper on "A Laboratory Method for the Study of Steam Condensate Corrosion Inhibitors," presented at the 8th Annual Conference, National Association of Corrosion Engineers, has been reprinted by Nalco for distribution to men interested in this problem. Your copy will be sent free upon request.

NATIONAL ALUMINATE CORPORATION
6218 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario

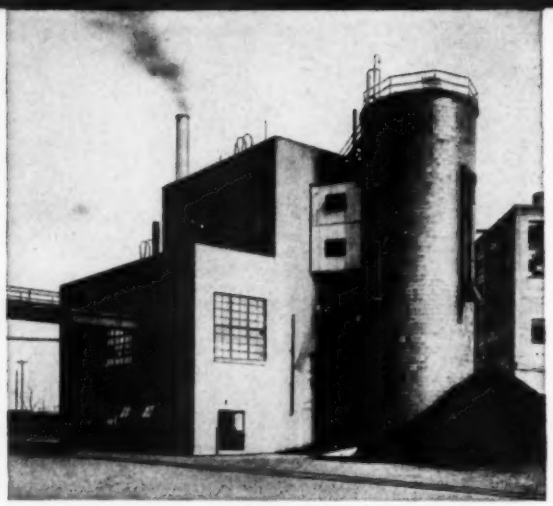
THE *Nalco* SYSTEM . . . Serving Industry through Practical Applied Science

Circle 508 on Reply Card for more data

Quaker Oats BURNING COAL

"Our new coal installation produces steam at a cost of 32¢ per 1000 lbs.... reduces some operating costs about one half,"

says Walter H. Proescholdt
Asst. Chief Engineer
The Quaker Oats Company



To gain economy plus dependability, Quaker Oats Company modernized the boiler room in its paper-making plant. One efficient, coal-fired unit now supplies all steam needed for heating, processing, and power generation.

Boiler and turbine room operations combined. With automatic controls and coal- and ash-handling systems, two men per shift can operate the combination boiler and turbine generator room shown above, right. Quaker Oats has found that burning coal the modern way certainly increases efficiency of operation and cuts operating costs.

Additional case histories, showing how plants of other types have saved money by burning coal the modern way, are available upon request.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

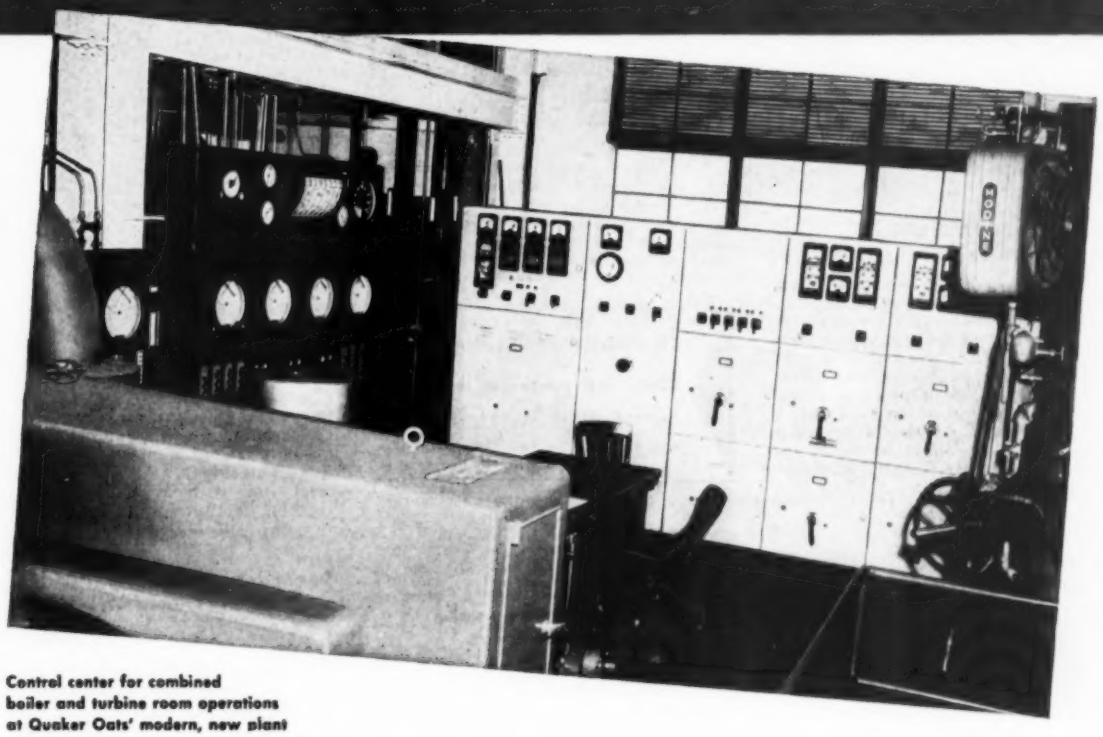
COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY
FOR LOW COST

REDUCES STEAM COSTS BY THE MODERN WAY



Control center for combined boiler and turbine room operations at Quaker Oats' modern, new plant

Many power plants over ten years old are as dated in efficiency as the automobiles of the same period. Ton for ton, coal burned in a modern plant can produce 10% to 40% more power. Modern coal- and ash-handling equipment can also cut labor costs substantially.

Why not let a consulting engineer look over your plant? Chances are he can point out ways of remodeling so that you can burn bituminous coal the modern way . . . and save dollars.

It pays to burn coal efficiently, because coal is not only an economical, but a dependable fuel. Coal reserves are virtually unlimited. America's coal industry is the world's most efficient and progressive. Thus you're assured of a plentiful supply of coal at relatively stable prices for generations.

BITUMINOUS COAL INSTITUTE

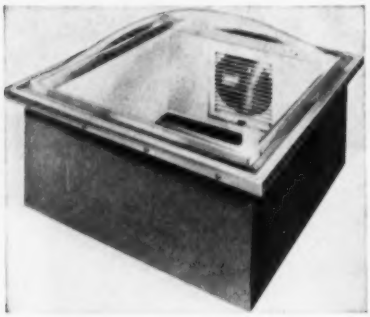
A Department of National Coal Association
Southern Building, Washington 5, D. C.

YOU CAN COUNT ON COAL!

Circle 509 on Reply card for more data

new equipment

—Starts on page 8

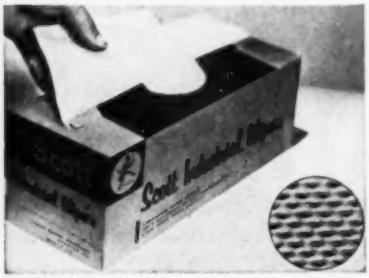


Skydome admits light and ventilation

L24 The Wascolite Ventdome developed by Wasco Flashing Co. brings daylight and ventilation to all interior areas in one easily installed prefabricated unit. It consists of an acrylic plastic Skydome, which admits glare-free daylight, and a built-in ventilating unit. Two design types are available: a powered unit with enclosed fan; and a gravity unit with adjustable aluminum louvers. No special roof, curb, or flashing is necessary.

Fork truck designed for use in crowded areas

L25 Cargo Scout, an electric-powered 2000-lb capacity fork truck has been designed by Elwell-Parker Electric Co. for fast operation in congested areas. Features include: end control; extra short wheelbase (43½ in.); 68 in. high uprights, and full initial lift to permit stacking in low head room areas; and heavy-duty drive axle to withstand high speeds and fast acceleration. The hydraulic lift mechanism provides controlled lowering and an automatic unloading device for overloads.



Wiper has high wet strength

L27 Specially designed to meet the general wiping needs of industry, a disposable industrial wiper has been developed by Scott Paper Co. It is said to be tough enough to use on machinery and smooth enough to use for cleaning eyeglasses.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.

Inspection instrument used for hard-to-reach areas

L28 Designed for inspection of interior surfaces and hard-to-reach areas such as between walls, is the Inspectro-Scope announced by Badger Sales Co., Inc. The object or surface to be inspected is illuminated by the lighted bulb at the tip of the En-tube. The image is picked up by the mirror and reflected back to the eyepiece where it is magnified 5 times. The lighted area is at a 45 deg angle to the long axis of the En-tube which revolves 360 deg allowing the viewer to inspect all inside surfaces or sides of an object without changing the position of the eyepiece.

Battery cells easily removed with cell-puller

L29 Users of storage batteries will find the cell-puller developed by Gould-National Batteries, Inc., useful in removing cells from batteries for examination or repair. The tool, generally used in sets of two, consists of a U-shaped steel loop brazed to a hexagonal steel nut with specially-cut threads tapering from bottom to top.

Recorder charts six measurements at once

L30 When attached to the pen arm of the Multi-Record Dynalog Recorder, made by the Foxboro Co., the tiny Alnico V permanent magnet is said to provide for precise and dependable measurements of temperature, pressure, humidity, and other variables all at once. Its function is to pick off, either at once or in sequence, six

Motor features improved lubrication and less weight per horsepower

L26 Polyphase a-c motors, offering better protection, more efficiency, and quieter operation have been announced by the General Electric Company's Small Integral and Medium Induction Motor Depts. Called Tri-Clad "55," they are 50 percent smaller by volume and average 22 percent less weight per horsepower, while retaining rigid cast-iron construction and incorporating a new insulation system, bearing assembly, and ventilation plan.

Keystone of the insulation system is a polyester film which is said to be 8 times as strong as previously used materials. A double-end ventilation system uniformly cools the motor by drawing air in from beneath both endshields, through carefully baffled air passages, and out louvers on the sides of the frame. The bearing assembly is more tightly sealed and is lubricated by a grease which lasts at least 5 times longer than formerly used lubricants. After the first of the year, the motors will be available in the 182 and 184 frame sizes (1, 1½, and 2 hp at 1800 rpm) in horizontal drip-proof, and totally-enclosed fan-cooled models, with a complete line of gear-motors.

Any way you figure it, corrosion of steam and condensate lines is a serious problem . . . and a costly one! Replacement of corroded lines, interrupted production, increased labor and maintenance send costs spiraling far beyond the limits of economical plant operation. But something can be done about it *right now*, with complete assurance of satisfactory results.

Take the case, for example, of a large plastics molding plant which operated the cycle on its molding machines alternately with steam and oxygen-saturated cooling water. Under these conditions, severe corrosion resulted. Check valves on the steam supply lines to the machines had an average life of only one week—*sometimes even less!* Costs were skyrocketing.

Here's what Betz did about it. By applying its patented filming amine treatment, piping and valve losses stopped *immediately!* After three years' treatment with this advanced technique, satisfactory corrosion control continues. What's more, plant records show savings in labor and maintenance have averaged 30 times the cost of the treatment applied.

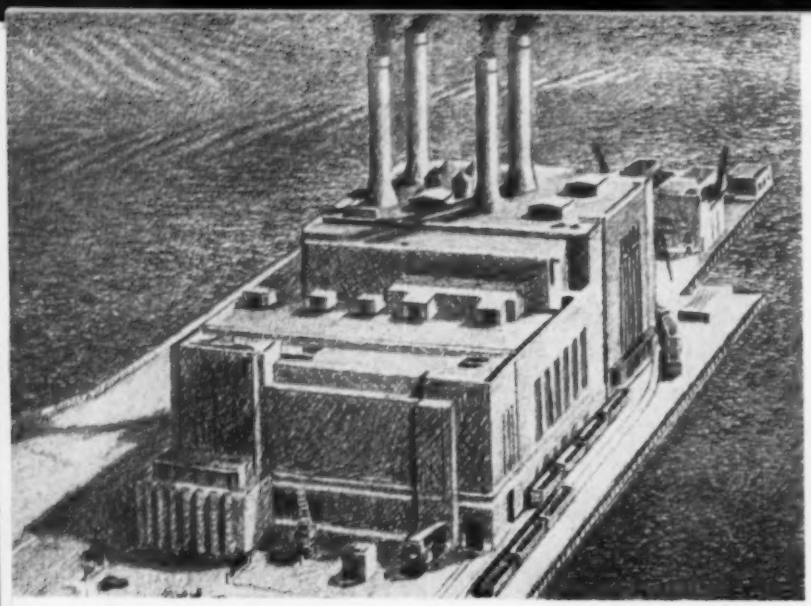
This is just one example of how Betz Engineers help keep plants *like yours* at peak operating efficiency. Why not get in touch with Betz today as the first step toward solving your particular water problems. There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

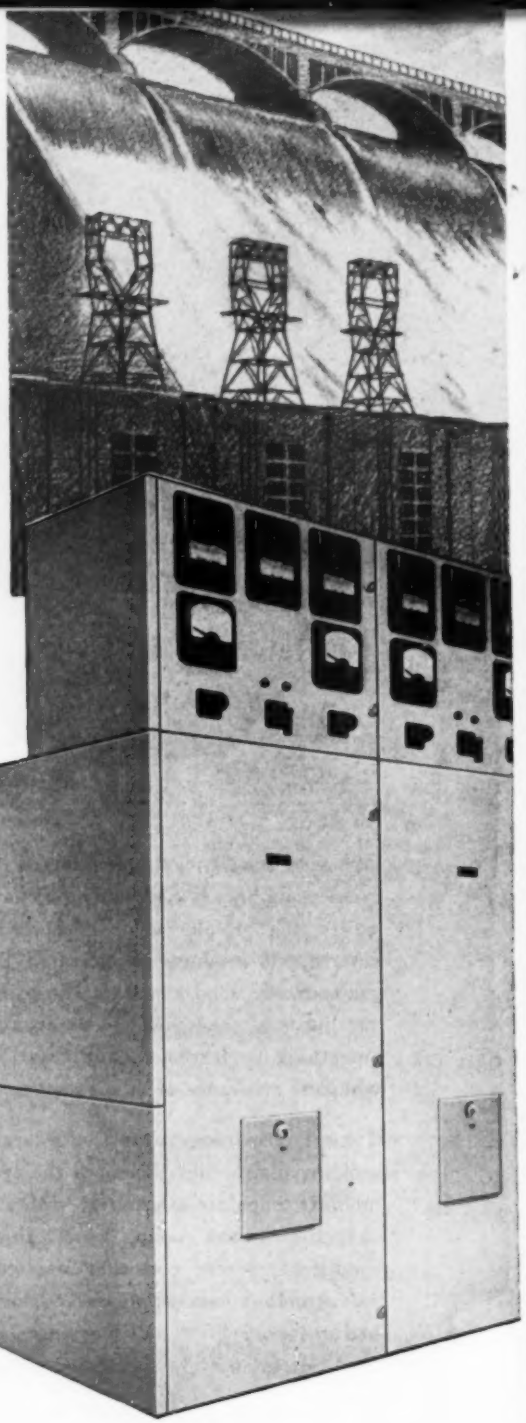
For the full facts and figures on how BETZ is solving return line corrosion problems in plants like yours, write today for Technical Paper No. 124.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

Circle 510 on Reply Card for more data





A TRILLION KWHR by 1965*

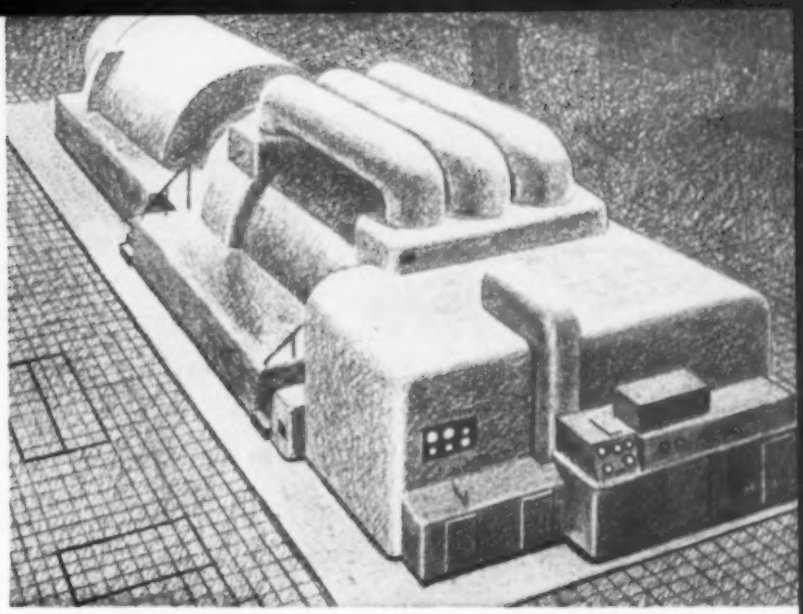
I-T-E is pacing America's greatest electrical expansion

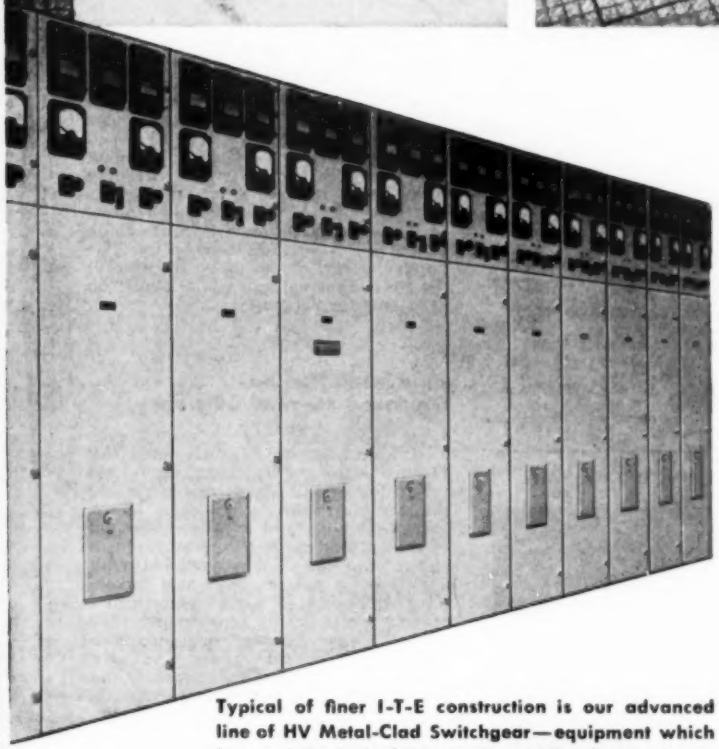
KWHR capacity has doubled in the past ten years and present trends indicate another doubling in the decade to come. New power generation, transmission, and distribution equipment—more of everything—will be required to handle this increased capacity.

In the past ten years, I-T-E has expanded some twenty fold—supplying quality switchgear for every type of industrial and commercial application. Look for even bigger strides forward—broader lines, more products, finer designs, and increased production—as I-T-E continues to pace America's greatest electrical expansion.

**Edison Electric Institute*

THE SYMBOL OF QUALITY IN SWITCHGEAR





Typical of finer I-T-E construction is our advanced line of HV Metal-Clad Switchgear—equipment which has met the test of time and provides the maximum in protection and efficiency at a minimum over-all cost.

For details, call the I-T-E field office nearest you. Look in your classified telephone directory under "Electrical Equipment."

Or—write for **Bulletin No. 7004B.**

I-T-E Switchgear embodies...

- **advanced engineering**
- **refined design**
- **quality construction**

Through 65 years, the I-T-E Circuit Breaker Company has achieved outstanding recognition in the industry by persistent effort to advance the switchgear art.

Many switchgear "firsts" are attributed to I-T-E, among them:

- the original Inverse Time-Element (I-T-E) circuit breaker
- the first enclosed circuit breakers and switchboards
- the first high-voltage air magnetic circuit breaker
- the first isolated-phase bus

In addition to the introduction of new ideas and thinking, I-T-E has devoted its engineering skill to accomplishing the ultimate in design and production refinement.

I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.

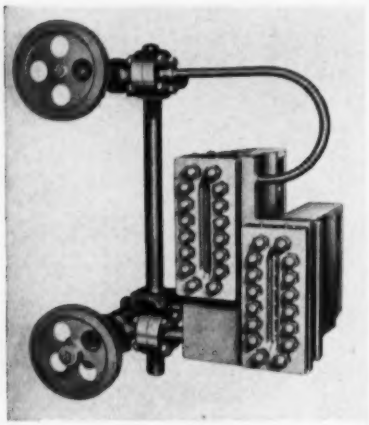
I-T-E Metal-Clad Switchgear

Circle 511 on Reply Card for more data

new equipment

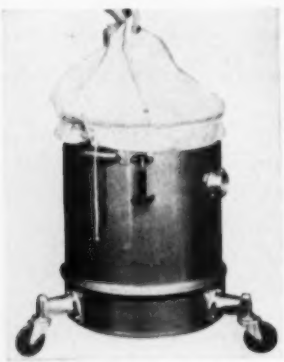
—Starts on page 8

differently colored pens. A full day's or week's record of up to 6 measurements can be completed on one circular chart. The recorder is for use wherever an accurate record of more than one measurement is required as in petroleum refineries and power stations.



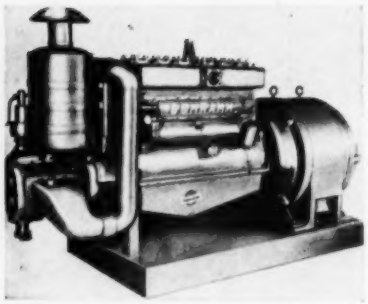
Breakage problem solved using short sections of glass

L31 To overcome the serious high pressure and temperature glass breakage problem in flat glass type gages Diamond Power Specialty Corp. has developed a gage in which the glass is divided into short sections and mounted with thin mica separators in the joints. These sectional glasses are furnished on all Bi-Color Gages operating at pressures over 135 psi. A bulletin is available.



Flame-proof bag is stronger

L32 Empire Chemical Products Co. now furnishes a flame-proof, disposable latex paper bag as standard equipment on its furnace and boiler cleaners. The bag is said to have 3 times the life of the ordinary bag.



Compact compressor can be moved by fork truck

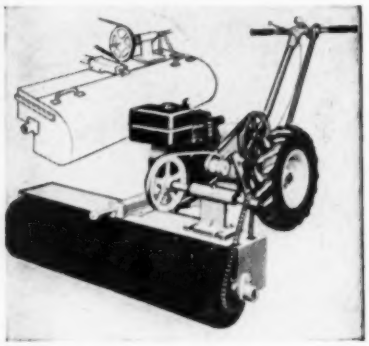
L33 Model 600 Super Unistage industrial compressor has been designed by Schramm, Inc. to provide 600 cfm of air at 100 psi. For unit system installation in large industries, the compressor is said to be just as suitable as a central supply of air where 600 cfm is sufficient to supply the entire air needs. Powered by a 150 hp induction motor, it has 43 percent greater capacity than the largest industrial unit formerly manufactured by this company, but requires little more actual floor space for installation. The unit can be moved from one location to another on a fork truck, and is available with running water cooling or with cooling unit built in with or without a hood.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.

Nylon port exchanger used for D-slide type valve

L34 D-slide type, 4-way valves with the port-exchanger slide being operated by a double acting cylinder or a spring return cylinder have been announced by Airelectric Corp. The Nylon port exchanger has been service tested to 50 million cycles and found to be undamaged, as was the pilot cylinder assembly which is of hard surfaced aluminum. Valves can be operated without lubrication where necessary, and for pressures from 3 to 200 lb. All of the valves can be operated manually or electrically by interchanging the operating valve units, and are capable of delivering media from full ¼ and ⅜ in. orifices.



Industrial sweeper is completely mechanized

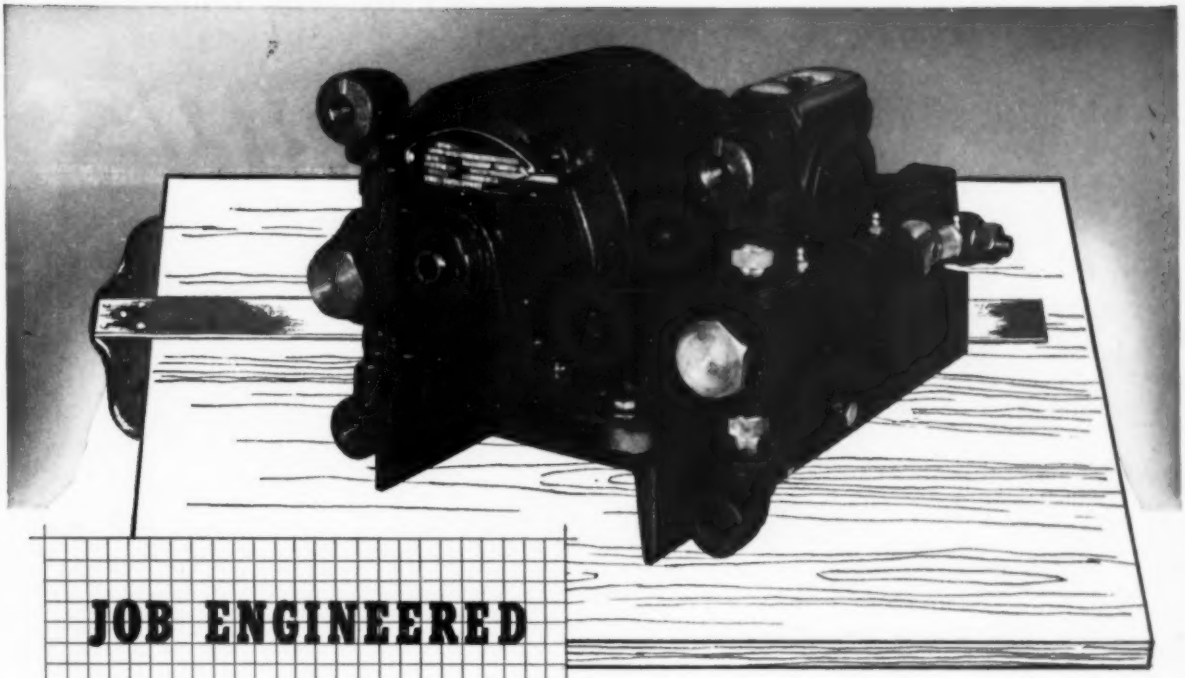
L35 To do an effective sweeping job on large pavement and floor areas, The Eshelman Co. has developed a completely motorized power sweeper. Said to be ideal for all types of sweeping jobs, it will even pick up metal shavings and comes complete with an all metal hopper that snaps on the front of the brush and has a 100 lb capacity. The hopper is easily unsnapped for emptying by one person and has a handle on each side for carrying.

Pipe insulation has improved thermal efficiency

L36 Finer fibered pre-formed pipe insulation manufactured by Owens-Corning Fiberglas Corp. is said to include all the advantages of the old product plus more resistance to abuse, easier handling, and improved thermal efficiency. For use at temperatures from sub-zero to 450 F, it is available with canvas coverings or vapor seal jackets for cold lines, and with a water-proof roofing felt jacket for outdoor use. The insulation is durable, fire-safe, noncorrosive, moisture resistant, easily fabricated, resilient, and provides no sustenance for insects or mold growth.

Powered wheelbarrows are electric starting

L37 Electric starting ¾ ton capacity powered wheelbarrows are being offered by The Prime-Mover Co. Only 32 in. wide, they go through standard doorways and maneuver easily in



JOB ENGINEERED

H-20 PUMP FOR DEPENDABLE LOW-COST SERVICE

For water treating services, and other applications that do not need the extremely high accuracy of Step-Valve liquid ends, Milton Roy offers the performance-proved H-20 Controlled Volume Pump.

This rugged pump has already gained wide acceptance in a variety of applications . . . in water treating installations, dry cleaning plants, bottling works . . . and as components of packaged steam boilers.

CAPACITIES: 3 to 12 gallons per hour in standard models.
MODELS: Simplex or Duplex (illustrated).
DISCHARGE PRESSURES: To 600 pounds per square inch.
MATERIALS OF CONSTRUCTION: Cast Iron and Stainless Steel.
PRICE: As low as $174.00 for cast iron construction, stainless steel trim, 300 psi discharge pressure, 6 gallons per hour maximum, ⅓ hp motor, single phase, 60 cycler, 115 volts, open.

Truly job-engineered, this dependable, low-cost H-20 pump includes such design features as double ball-checks on suction and discharge . . . spring-loaded packing that insures proper tension . . . construction for mounting any standard NEMA frame ¼ hp or ⅓ hp motor . . . simplicity in converting to duplex model.

H-20 is the latest product of Milton Roy . . . manufacturing engineers of controlled volume pumps and complete chemical feed systems for all industry.

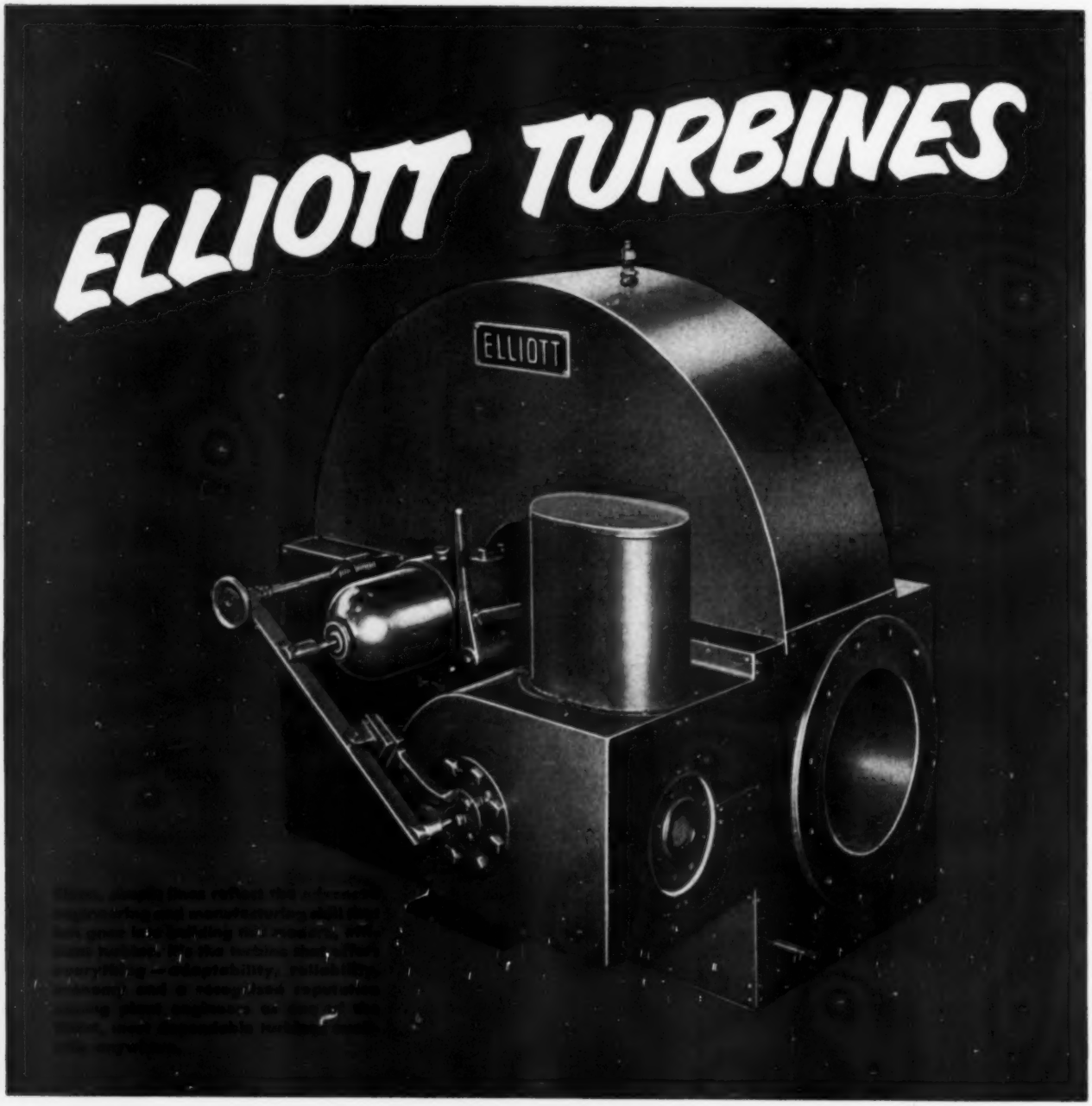
For complete illustrated technical data, write *today* for *new free Bulletin H20M.*

MILTON Roy COMPANY
Manufacturing Engineers
1319 E. MERMAID LANE • PHILA. 18, PA.

CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

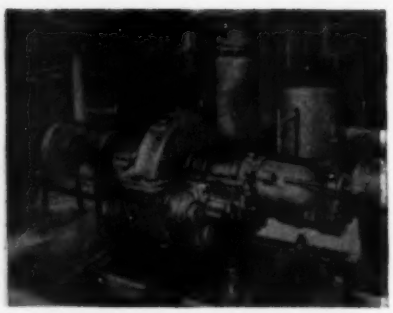
Circle 512 on Reply Card for more data

ELLIOTT TURBINES



Elliott 360-hp, 3550-rpm turbine driving a boiler-feed pump in a paper mill, exhaust steam being used in process.

Elliott 500-hp turbine driving a hydraulic system pump in a steel mill. Turbine maintains constant pump discharge pressure.



One of a group of Elliott turbines driving lean oil pumps in a cycling plant, where reliability is especially important.

A standard turbine—yet "tailor-made" to your requirements

Elliott Turbines can be adapted to practically any operating condition or service

That's because these powerful, compact turbines are designed to give you the advantages of custom-built adaptability at savings achieved through mass production of standardized parts. A wide variety of permissible modifications are possible. For instance... five sizes of YR turbines cover the entire range of capacities up to 2000 hp, speeds from 800 to 7000 rpm and back pressures from 4 in. Hg to 250 psig. Standard designs of rotor, governor, bearings, bearing cases, steam chest, governor valves and governor linkage are used throughout. In the case of higher pressures and temperatures up to 850 psig and 900 F, materials for steam parts may be changed from cast iron to steel.

Here are a few of the design highlights that are included in Elliott turbines:

Air-wall labyrinth seals to protect bearings from contamination without rubbing contact.

Centerline support to provide constant alignment under any operating condition.

Stainless steel spray coating under packing glands to eliminate corrosion of the shaft.

Choice of many governors to meet specific control requirements.

Liner type bearings to eliminate the need for scraping and fitting.

Packing glands removable without raising turbine upper half casing to simplify inspection and maintenance operations.

Stainless steel buckets and shroud to assure maximum life and continued high efficiency.

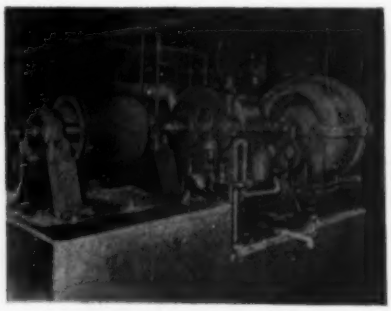
These and many other features are *standard* in Elliott turbines. They are the result of years of practical experience in the application of turbines to hundreds of different types of plant equipment and to many different types of operating and steam requirements.

Full details on Elliott Mechanical Drive Turbines can be obtained from your local Elliott representative or by writing Elliott Company, Jeannette, Pa., for a descriptive bulletin.

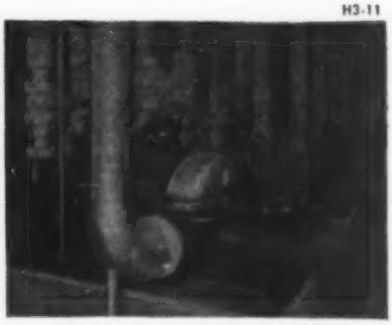
ELLIOTT Company
STEAM TURBINE DEPARTMENT

H3-11

This Elliott 202-hp turbine drives an induced-draft fan through a separate reduction gear, in a midwestern generating station.

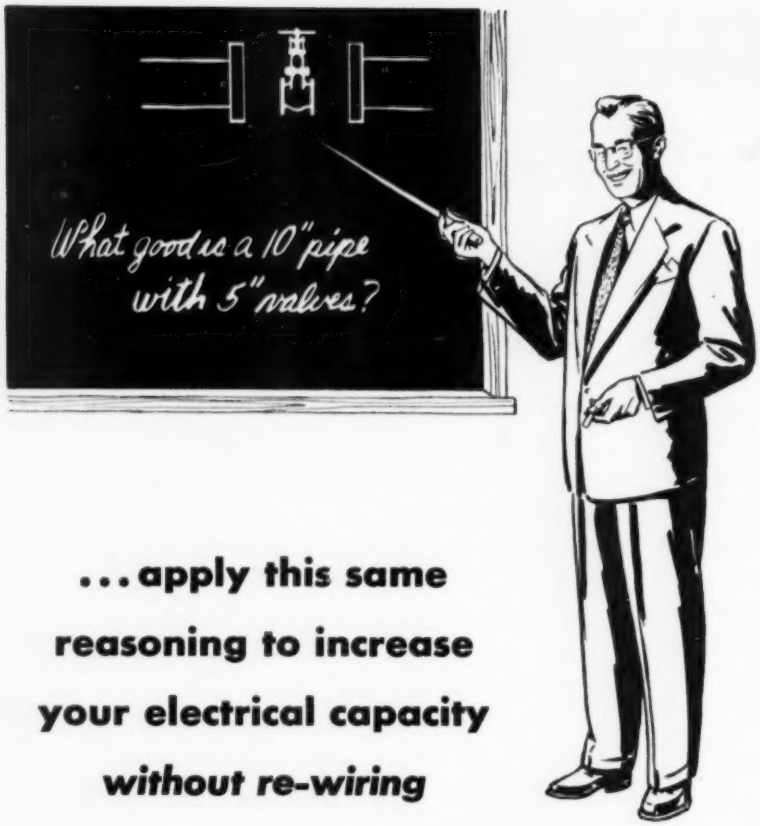


An Elliott 250-hp geared multi-stage turbine driving a paper machine. Governor gives close regulation over a wide speed range.



This line of oil pumps is driven by Elliott turbines. This is one of many refinery applications for Elliott turbines.

Circle 513 on Reply Card for more data



...apply this same reasoning to increase your electrical capacity *without re-wiring*

DE-RATING of circuit breakers is like going to the expense of a large pipe line, then installing small valves. Isn't it foolish to install wiring and conduit, for example, rated at 20 amperes, then use circuit breakers or fuses that de-rate the entire system to 12 amperes or less?

For this reason, most plants are never able to utilize the full safe capacity of their branch electrical circuits. This is simply because *most* circuit breakers require *de-rating* to allow for ambient temperature changes.

HEINEMANN Circuit Breakers never need de-rating . . . because their operation is not affected by room or panel box temperature. They do not employ thermal elements . . . so that you can always use the full rated capacity of the line with complete safety. You can have this extra capacity for only the small cost of replacing with Heinemann Circuit Breakers . . . they're interchangeable with most standard breakers.

Write for Bulletin No. 3101.

don't use heat...*USE POWER*

HEINEMANN ELECTRIC COMPANY
140 Plum Street • Trenton 2, New Jersey

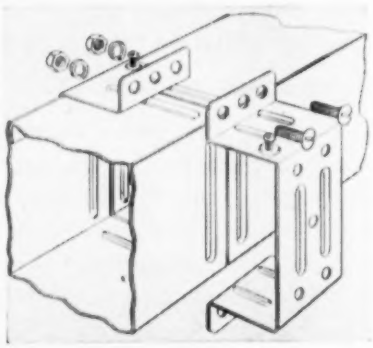
HEINEMANN *Circuit breakers*

Circle 514 on Reply Card for more data

new equipment

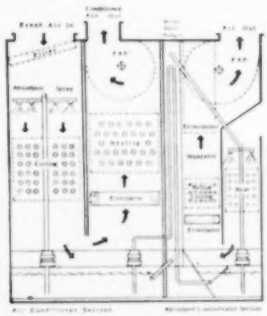
—Starts on page 8

confined areas. Two sizes of flatbed platforms are interchangeable with the 10 cu ft bucket for moving heavy maintenance items as well as hauling scrap and refuse. They also feature a blade unit for removing snow and scraping litter, and a 55 gal sprayer attachment for weed and insect control.



Flush-wall mounting possible with two-piece coupling

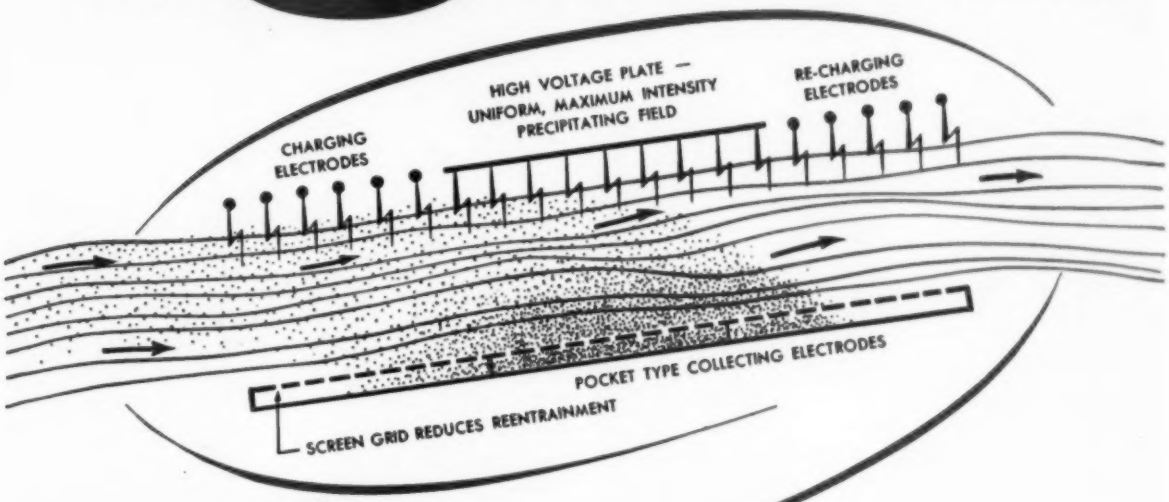
L38 Two-piece, squeeze-type couplings for joining lengths of wireway have been introduced by National Electric Products Corp. The 4 x 4 in. electrical raceway sections of 1, 2, and 5 ft lengths have hinged covers for accessibility and are ridged to key into the individual wireway sections and assure perfect alignment. Developed especially for use where several wireway sections are pre-assembled, the coupling provides complete rigidity, enabling the lifting of the sections into place as a unit, and permits flush wall mounting through holes pre-drilled.

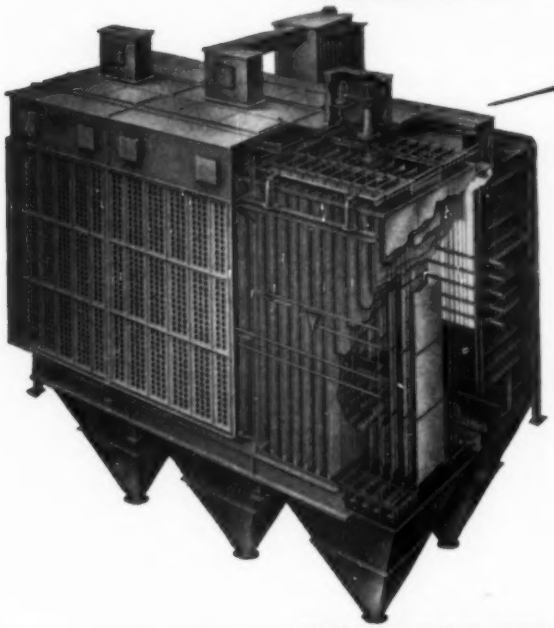


Unit combines air conditioner and absorbent re-concentrator

L39 Improved apparatus for treating air with an absorbent spray to fix relative humidity in air conditioning or air drying has been announced by Niagara Blower Co. In this model, Series 5700, the air conditioner and absorbent re-concentrator are combined

The reasons for High Efficiency with AEROTEC Electrical Precipitators


HIGH VOLTAGE PLATE — UNIFORM, MAXIMUM INTENSITY PRECIPITATING FIELD
RE-CHARGING ELECTRODES
CHARGING ELECTRODES
POCKET TYPE COLLECTING ELECTRODES
SCREEN GRID REDUCES REENTRAINMENT



Exclusive design of the charging and collecting electrodes is the principal reason why Aerotec Electrical Precipitators assure higher precipitation efficiency and retention of dust particles.

In the first zone of the unit, six high-voltage wires charge the dust. A flat high-voltage plate provides an area of maximum field intensity in the second zone, and forces the charged particles toward the collecting electrode. This high-voltage plate reduces power input, as it is not a discharge element, and results in a maximum, *uniform* precipitating force.

The collecting electrodes are of a pocket-type design. They provide a recessed, comparatively quiet section for retaining the dust. Aerotec collecting electrodes are composed of a flat plate, vertical baffles, and a screen grid that acts both as a mechanical and electrical barrier.

Particles or agglomerates are not exposed to the direct scouring action of the gas stream and are therefore less likely to be reentrained.

The pocket-type electrode further reduces reentrainment as the vertical baffles and screens form channels through which dust falls to storage hoppers. The Aerotec design utilizes continuous short interval rapping. Heavy build-up on the collecting electrodes is thus eliminated, resulting in a consistently clean stack.

The Thermix Corporation, Project Engineers for the Aerotec Corporation, will be glad to help you in the solution of your dust problem. Why not contact them for further details on this highly efficient method.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 Principal Cities)

Canadian Affiliates: **T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario**

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.

Circle 515 on Reply Card for more data

This Test Shows Why

Trane Gas-Fired Unit Heaters give you

Maximum Heat Per Fuel Dollar!

Hold your hand beside a flame. You can hardly feel the warmth! The heat rises rapidly in a narrow column—not toward your hand, *but straight up!* It escapes without heating your hand.

Now put your hand directly over the flame. You get the *full force* of practically all the heat generated by the flame. It hits your hand squarely—mushrooms out over the entire surface.

The NEW TRANE Gas Unit Heater

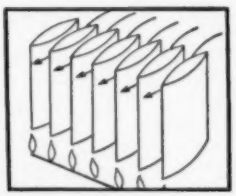
A.G.A. APPROVED—This great new heater, when tested by the American Gas Association against a long list of construction requirements, not only met the specifications—but surpassed them. It combines *increased output* with *unequaled strength* and *outstanding styling*. It gives you maximum heat transfer, maximum service, maximum efficiency.

EXCLUSIVE HEAT DIFFUSION—The patented TRANE Louver Fin Diffuser available with these units gives you complete command of air direction. Funnel it into a concentrated stream. Split it. Or spread it evenly over a wide area.

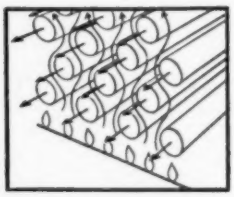
Projection Heater

Model H Unit Heater

Valves and Traps



Conventional gas heaters have *vertical* chimney-like tubes. Heat rushes through in quick escape. Contact of heat with inside surface is brief. Heat escapes out the top. Room air is blown past the outside surface of the tubes. You can see why this can be so inefficient.



The new TRANE unit has *horizontal* "boiler tube" construction. Heat strikes tubes squarely—mushrooms around them, rises to the row above. Each tube is *bathed* in heat. Air to be heated is forced through tube's oven-like interior. Result: maximum B.T.U's per fuel dollar.

TRANE

GAS-FIRED UNIT HEATERS

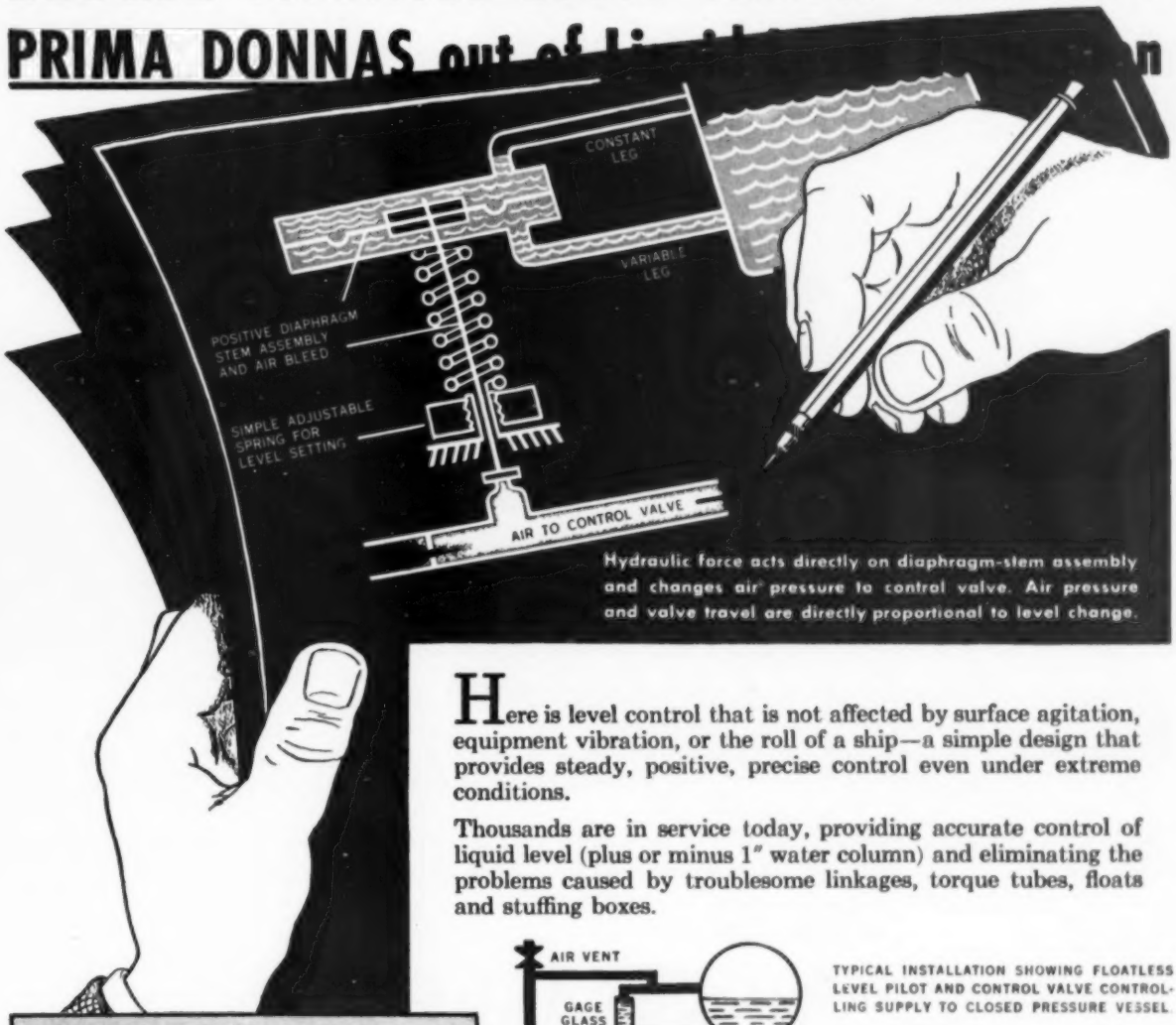
Cut fuel costs . . . put heat where it's needed

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

The Trane Co., La Crosse, Wis. • Eastern Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U. S. and 14 Canadian Offices

Circle 516 on Reply Card for more data

LESLIE *Floatless* Level Control takes the PRIMA DONNAS out of li...n


CONSTANT LEG
VARIABLE LEG
POSITIVE DIAPHRAGM STEM ASSEMBLY AND AIR BLEED
SIMPLE ADJUSTABLE SPRING FOR LEVEL SETTING
AIR TO CONTROL VALVE

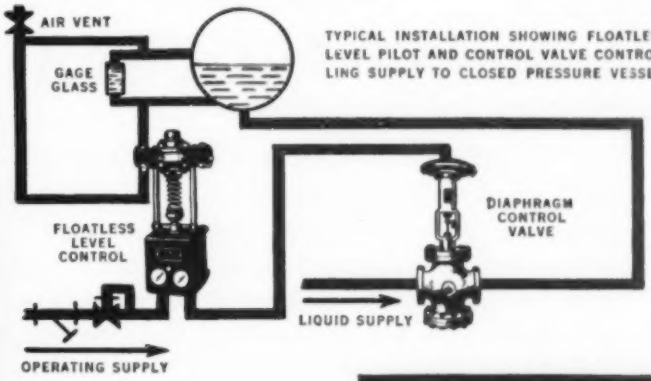
Hydraulic force acts directly on diaphragm-stem assembly and changes air pressure to control valve. Air pressure and valve travel are directly proportional to level change.

Here is level control that is not affected by surface agitation, equipment vibration, or the roll of a ship—a simple design that provides steady, positive, precise control even under extreme conditions.

Thousands are in service today, providing accurate control of liquid level (plus or minus 1" water column) and eliminating the problems caused by troublesome linkages, torque tubes, floats and stuffing boxes.

Note these special features—

1. **Can be installed anywhere below liquid level . . . on control panel, if desired.**
2. **Simple, compact, one adjustment unit . . . weighs only 40 lbs.**
3. **Diaphragm stem assembly is only moving part. Diaphragm element doesn't require recalibration during service.**



TYPICAL INSTALLATION SHOWING FLOATLESS LEVEL PILOT AND CONTROL VALVE CONTROLLING SUPPLY TO CLOSED PRESSURE VESSEL

SEND FOR DESCRIPTIVE DATA PC-37

When specifying . . .

Here's *another* LESLIE *standard* item to fit specifications that are *special* orders with most manufacturers. When specifying pressure, temperature or level controls—for new or replacement service—it will pay to check *first* with your nearest LESLIE engineer. He's listed in the classified telephone directory in principal cities . . . under "Regulators" or "Valves"

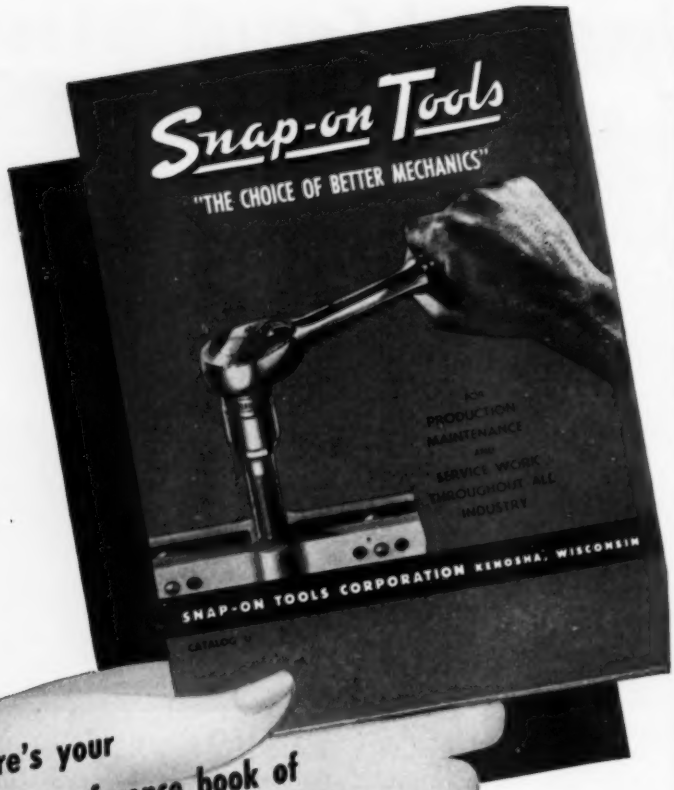
LESLIE

TOPS IN QUALITY PRESSURE LEVEL AND TEMPERATURE CONTROLS

Since 1900

LESLIE CO., 263 Grant Avenue, Lyndhurst, New Jersey

Circle 517 on Reply Card for more data



Here's your handy reference book of 4,000 time-saving tools for production and maintenance

NEW Snap-on CATALOG

WRITE FOR YOUR COPY TODAY!

You'll want this latest 104-page edition of the most complete, most informative tool catalog published! This catalog lists all sizes and types of wrenches from largest needed on heavy machines to small ones for use on delicate instruments. Special tool equipment for fast repair of diesel and other engines. Includes new tools engineered by Snap-on to help handle difficult jobs with greater speed and safety. Write for your copy today.

SNAP-ON TOOLS CORPORATION
8102-K 28th Avenue, Kenosha, Wis.

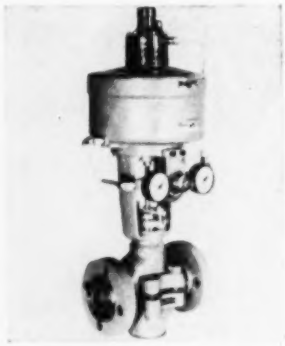
Snap-on is the trademark of Snap-on Tools Corporation.

Circle 518 on Reply Card for more data

new equipment

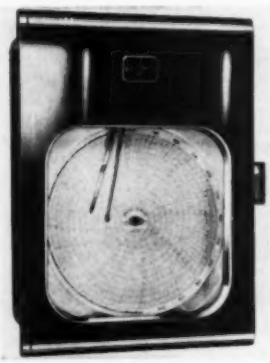
—Starts on page 8

in one machine so that equal capacity is provided in less than half the space required by previous models. It is available in capacities of 1000 to 5300 cu ft of air per minute.



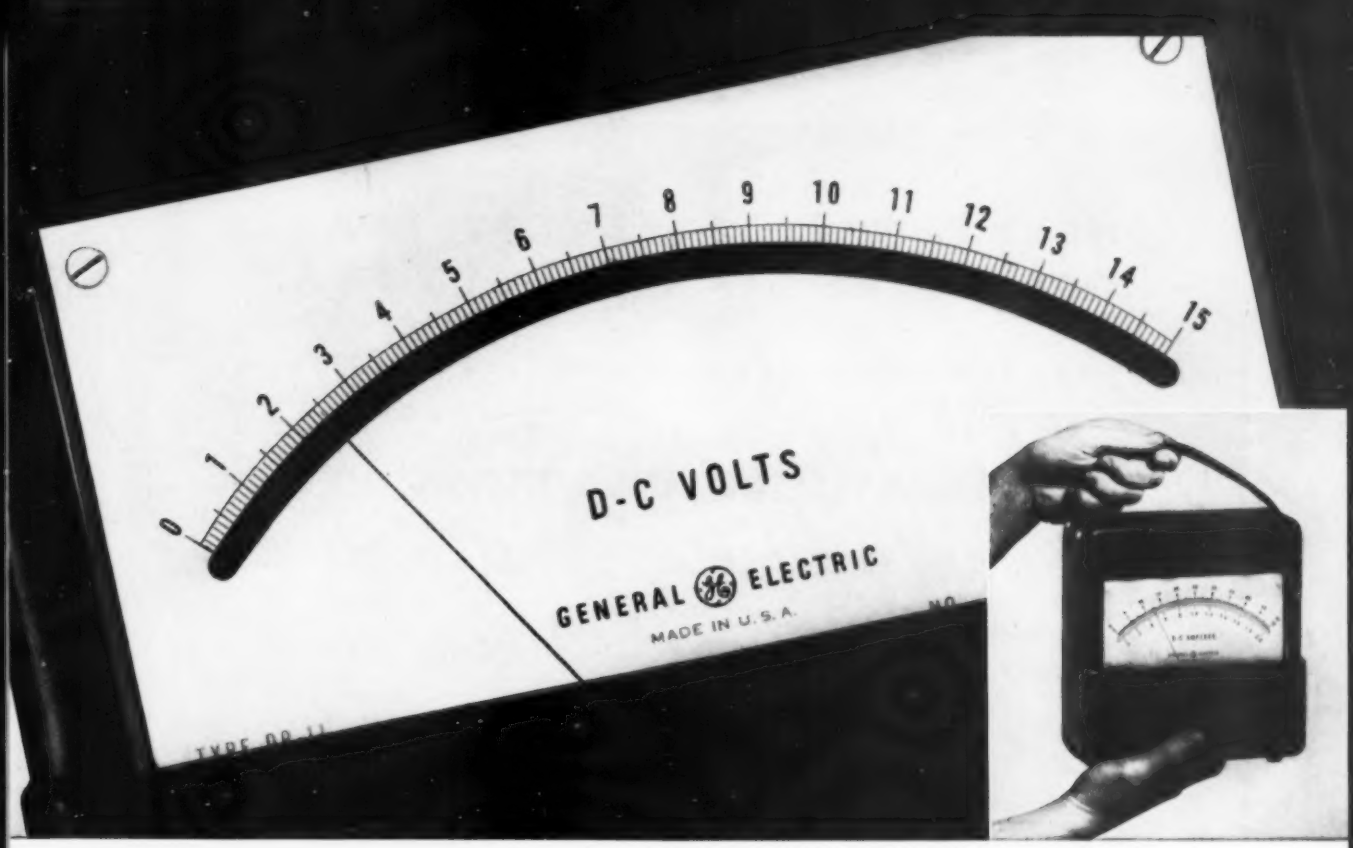
Accurate, sensitive control possible with valve

L40 Conoflow Corp. has announced an addition to their line of control valves to be known as the LB Series. The series is said to include a new concept of valve topworks and when coupled with the single seated, split body valve design should result in an assembly that will fulfill the exacting requirements of the processing industries for accurate, sensitive, and positive control of many hard-to-handle fluids. The valve can be positioned accurately to over one part in 1000 of instrument output span. The series is available in sizes to 4 in. for Series 15, 30, and 60 body ratings.



Controllers adaptable to varied control problems

L41 Free-Vane Electronic Controllers added to the Series 500 line of The Bristol Co. are available as indicating or recording controllers for temperature, pressure, flow, liquid level, humidity, and time program control.

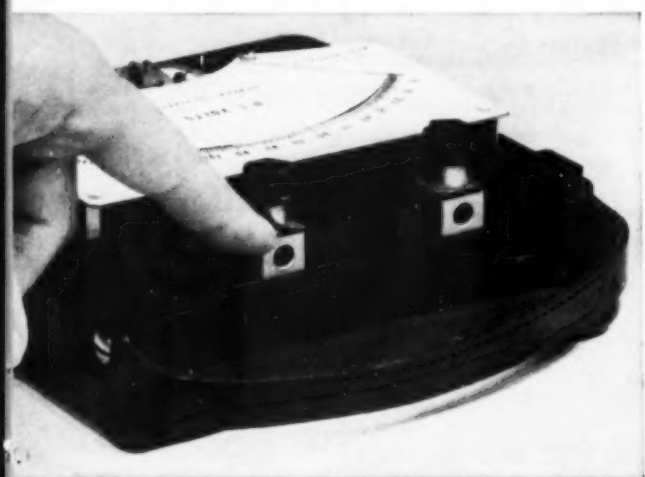


YOU READ IT RIGHT—THE FIRST TIME . . .

New G-E Portable Indicating Instrument Designed to Reduce Costly Reading Errors

No matter how high the rated accuracy of a testing instrument may be, operator errors in reading that instrument give you costly false reports.

General Electric's new line of d-c portable indicating instruments offers you the surest way of controlling these expensive reading errors. Designated Type DP-11, the design of these instruments eliminates the factors which tend to encourage false readings.



NEW REAR-SET TERMINALS accept many connector types—spade, plug, others; reduce twisting of leads, high-potential hazards.

IMPROVED READABILITY

The dial of the DP-11 indicator is a long, readable 5½ inches. Figures are legible and liberally spaced for quick positive reading.

Readability is further increased by the molded plastic window, which permits flooding the entire scale with light from the front and three sides—to eliminate shadows.

MANY TYPES AVAILABLE

You can get the DP-11 in any one of several ranges and types—as ammeters, voltmeters, millivoltmeters, milliammeters, or microammeters. Rated accuracy is within ½ of 1% of full scale.

Twin to the DP-11 line is the new DP-12 instrument group—for those applications where an accuracy of ¼ of 1% is desired.

MORE INFORMATION

For further details on how the DP-11, -12 instruments can help you to speedier, surer measurements, contact your G-E Apparatus Sales representative or write for Bulletin GEC-979 to Section 602-266, General Electric Company, Schenectady 5, New York.

You can put your confidence in—

GENERAL ELECTRIC

Circle 519 on Reply Card for more data

HERE'S A STORY EVERY PLANT OPERATING MAN SHOULD READ

"Heating in our main switch was causing Shutdowns But we stopped them cold by changing to Fusetron dual Element Fuses"

"In the Fall of 1951 in our cafeteria, we installed a new 1200 ampere switch. This switch controlled the lighting, refrigeration and a 115 ton air conditioning load.

"Everything was fine until the temperature reached 85 degrees and the summer air conditioning load came on. Then we had trouble.

"Three times in May, 1952 during our noon rush our whole place was shutdown.

"Our dining rooms seat 500 people at a time, so you can see what a shutdown during the noon rush means to us.

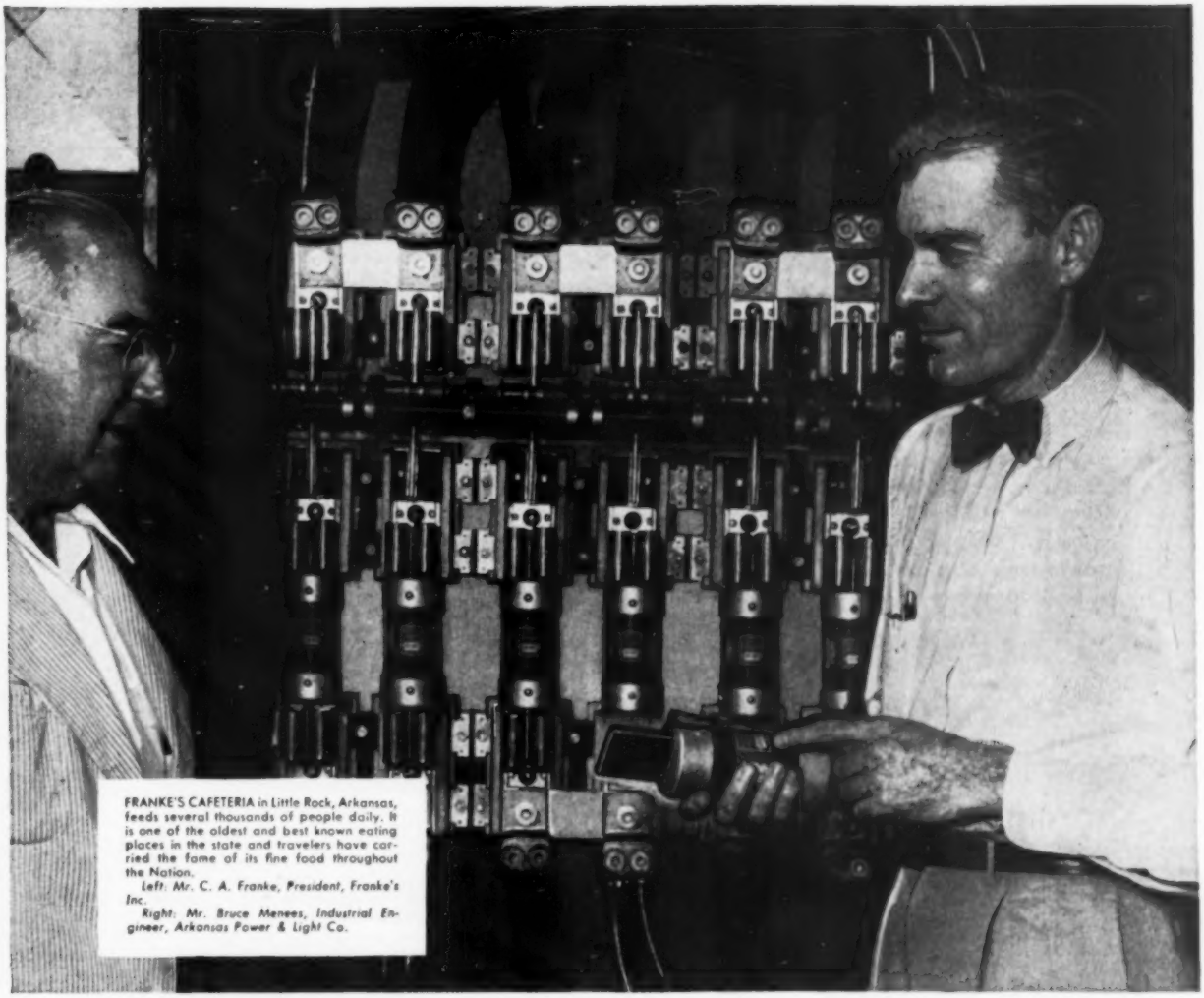
"We were fighting mad about the whole affair as the installation was practically new. Mr. Menees of the Arkansas Power and Light Co. was called in.

"He suggested that the trouble was due to the adding of the summer temperature to the normal heating of the fuses. Then he recommended that we discard our ordinary fuses and install FUSETRON dual-element fuses, as these modern fuses operated at a much cooler temperature than other fuses.

"This we did. To date, June 19, 1953, over one year since we made the change we have not had a shutdown due to a fuse blowing even though today's temperature outside is over 100 degrees.

"The cooler operation of FUSETRON fuses stopped shutdowns cold for us."

C. A. Franke, President
Franke's Inc., Little Rock, Ark.



FRANKE'S CAFETERIA in Little Rock, Arkansas, feeds several thousands of people daily. It is one of the oldest and best known eating places in the state and travelers have carried the fame of its fine food throughout the Nation.

Left: Mr. C. A. Franke, President, Franke's Inc.

Right: Mr. Bruce Menees, Industrial Engineer, Arkansas Power & Light Co.

You too, can profit by the 10 POINT PROTECTION of FUSETRON dual-element FUSES

1 •Protect against short-circuits.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.

4 Provide thermal protection—for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

•Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York.

FUSETRON is a trademark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

FUSETRON

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

FOR MORE INFORMATION *use this Coupon*

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ 1153

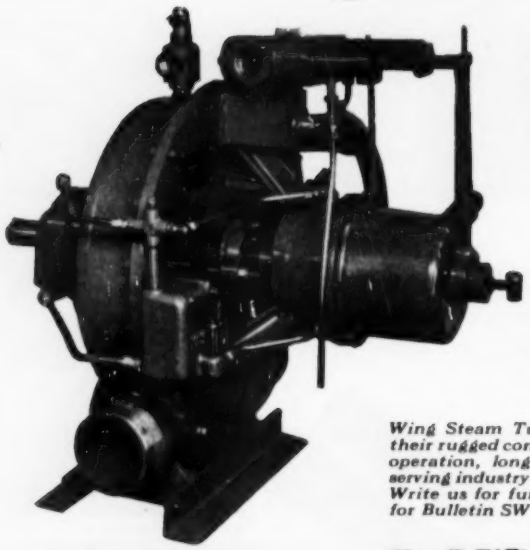
Circle 520 on Reply Card for more data

IF YOU USE STEAM FOR HEATING — COOKING OR PROCESSING—

You can get POWER at almost no cost!

Wing Steam Turbines cost little or nothing to operate where their oil-free exhaust steam can be used in process operations—or in space heating. The Turbine acts as a reducing valve . . . its exhaust steam has been reduced to the pressures used in heating and cooking operations. Wing Steam Turbines give an infinite range of speeds, easily controlled by throttling—and they are completely independent of any electric power failure.

WING STEAM TURBINES



Wing Turbines furnish smooth, dependable power for compressors, pumps, fans, blowers, winches, generators, mixers and similar equipment.

OPERATING RANGES

Horsepowers to 150 b.h.p.

Temperatures to 750°F.
Pressures to 600 p.s.i.
Back Pressures to 50 lb.
Speeds to 4000 r.p.m.

Wing Steam Turbines are known for their rugged construction, trouble-free operation, long life. They have been serving industry for over a half-century. Write us for further information. Ask for Bulletin SW-1a.

L. J. Wing Mfg. Co.

139 Vreeland Mills Rd.
Linden, N. J.

Factories: Linden, N. J. and Montreal, Can.

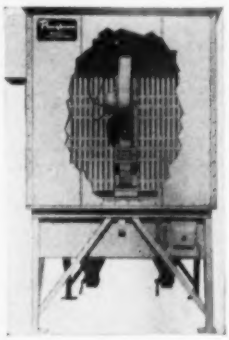
Wing

Circle 521 on Reply Card for more data

new equipment

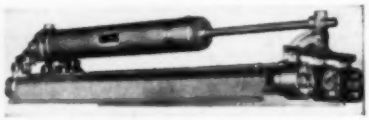
—Starts on page 8

Based on a frequency modulation principle, the controllers are offered for low-open, high-open, low-high, low-open-high or low-normal-high control as well as proportional input control. Various combinations of recording pens and control units in one case make controllers adaptable to a wide range of problems. A bulletin is available.



Dust collector is self-cleaning

L42 Pangborn Corp. announces production of type CH-3 self-cleaning cloth screen dust collector which lowers operating and maintenance costs by permitting continuous automatic dust collection, constant air volume and suction, and positive reverse flow filter cleaning. Standard sizes are furnished with 6-screen-high construction. Also available for small air volume problems are 4 and 5-screen-high by 5 ft long screen sections. Existing installations of Pangborn type CH collectors can be converted to the self-cleaning arrangement by removal of mechanical rapping mechanism, replacement of grid wall, and slight alterations to screen frames and clamping devices.



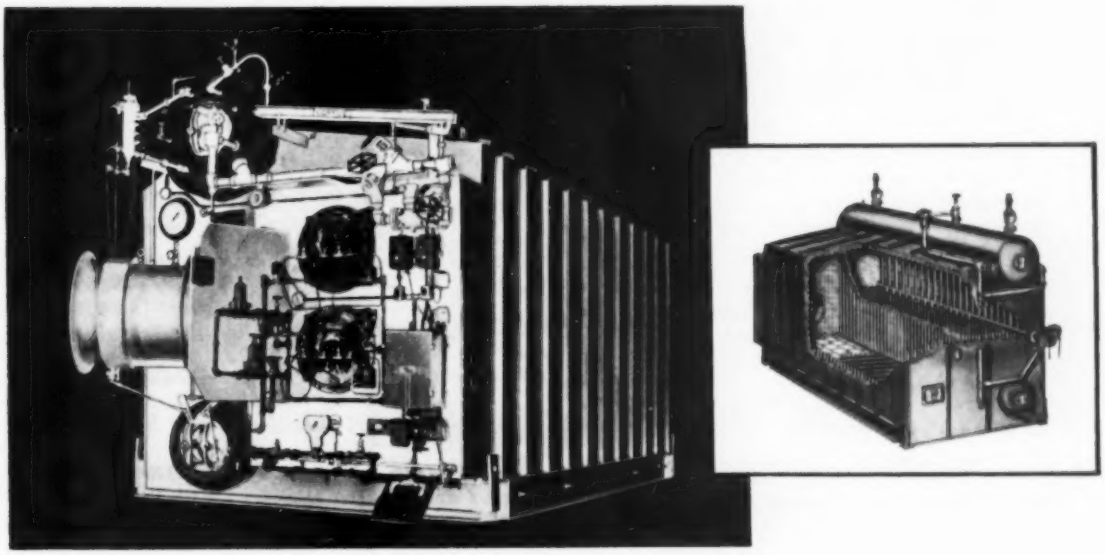
Dust-tight fluorescent lighting fixture is explosion-proof

L43 Explosion-proof, dust-tight fluorescent lighting fixtures for use wherever the presence of explosive gases or vapors or combustible dusts requires safe, practical lighting have been introduced by Crouse-Hinds Co. The fixture may be spaced end-to-end with other fixtures of the same type, making possible continuous and uniform illumination along work areas. Tools are unnecessary to release lamp receptacle and mounting plate assembly; a slight twist of the wrist locks or unlocks it.

low-cost steam

where you need it—when you need it

with the FW PACKAGE STEAM GENERATOR

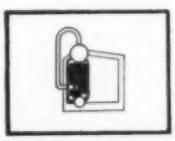


■ Foster Wheeler Package Steam Generators make it possible for you to have 7,500 to 35,000 lb of steam per hr depending on operating conditions. Standard designs for pressures of 250, 525, or 825 psi are available to meet your requirements for an economical source of steam "where you need it—when you need it."

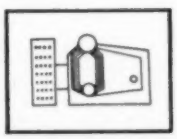
These plant-assembled, water-tube steam generators can easily be transported to your plant by common carrier, set on a simple foundation in a minimum space at the location best suited to your needs, and quickly put in operation after a few simple service connections. For small and medium-size plants a single unit will meet your needs for low-cost heating or process steam. Large plants have found multiple-unit installations to be the economical answer to their requirements up to 150,000 lb per hr.

For economy in installation, operation and maintenance, the Foster Wheeler Package Steam Generator offers a combination of features which incorporate many of the improvements and technical advancements of over 50 years of experience in steam generation. For more specific information write to Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.

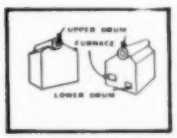
FEATURES THAT DISTINGUISH FOSTER WHEELER PACKAGE STEAM GENERATORS



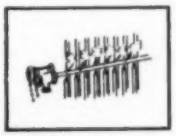
HIGH STEAM TEMPERATURES. Provisions for superheaters in some designs.



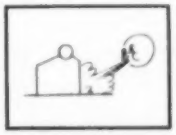
ECONOMIZERS. For larger capacity installations, package economizers can be supplied to provide minimum fuel costs.



ACCESSIBILITY. For inspection, cleaning, maintenance.



CLEAN HEATING SURFACES. Soot blowers incorporated . . . cleaning without boiler shutdown.



HEAT LOSS MINIMIZED. Minimum heat loss — from radiation and air infiltration.

RAPID LOAD SWINGS. Large diameter drums and ample furnace heating surface.

FOSTER WHEELER

Circle 522 on Reply Card for more data

Just listen to how one user puts SCHRAMM to work . . .

"Our Schramm 105 is operating 16 hours a day", writes H. J. Lockwood, Plant Superintendent, Mullenbach Electrical Manufacturing Company, Los Angeles, "and during the day shift is on a 75% duty cycle.

"Considering that our usage of air at the time of the installation a year ago was 15% duty cycle, you can see how we have put air to work for us".

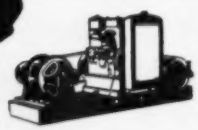
Schramm Stationary Air Compressors are chalking up similar performance records elsewhere. Users mention their "economy of operation", their "versatility", their ability to be used as a "unit system" installation.

You too will find Schramm Air Compressors offer many advantages and provide real savings. For further information on our complete line of air compressors write today.

SCHRAMM, INC.

The Compressor People

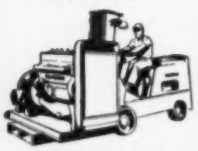
WEST CHESTER • PENNSYLVANIA



COMPLETE PACKAGE

COMPACT

UNIT SYSTEM



EASY TO MOVE

NO FLABORATE FOUNDATION

VIBRATIONLESS

LOW MAINTENANCE

LOW INITIAL COST

Circle 523 on Reply Card for more data

letters

. . . from readers

Credit Where Due

Sir:

I would like to call to your attention the fact that there was an important omission in the bibliography carried with the article, "Can Your Boiler Burn Another Fuel," in the October 1953 issue. It should have shown the name of Biglow-Liptak Corporation as the basic developer of the charts and curves used. It is important that this company be given full credit for this work.

William S. Major
Machinery Div., Dravo Corporation
Pittsburgh, Pa.

Assured Interest

Sir:

The article ("Prevent Moisture Absorption by Heating Motor Windings," August INDUSTRY AND POWER) was brought to my attention by one of our assureds. The article was very interesting and proved to be quite interesting to the other engineering personnel of this office . . . . I would appreciate receiving this worthy publication (INDUSTRY AND POWER).

A. J. Horlock
The Travelers Insurance Co.
Chicago, Illinois

Control Valves and Positioners

Gentlemen:

We would be grateful to receive a copy of your special report on control valves and positioners. This is the most complete summary I have ever seen written, and I am sure we will find it excellent reference for our use in the design of test equipment for jet engines.

F. J. Fennessy
Pratt & Whitney Aircraft
Div. of United Aircraft Corp.
East Hartford, Conn.

Feedwater Heating

Sir:

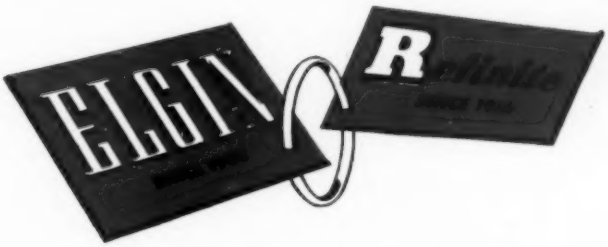
We would appreciate your forwarding six copies of the following article which appeared in your May 1953 issue: "Feedwater Heating Calculations for Steam Turbines" by E. V. Pollard.

We believe our engineering department will find this article very useful.

Arthur H. Kuljian
The Kuljian Corporation
Philadelphia, Pennsylvania

Announcing:

WATER CONDITIONING'S GREATEST STRIDE AHEAD!



Two leaders join forces to give you A New and Broader Water Conditioning Service

Yes, two of the great names in water conditioning are united: Refinite Sales Co. has joined Elgin Softener Corporation. Now it is "Elgin-Refinite, Inc." . . . and this linking of products, experience, men and methods truly marks the beginning of a new era for those who seek the answer to a water conditioning problem.

You know these firms. Both have played major roles in water conditioning for a long time: Elgin since 1908; Refinite, since 1916. But now — through the pooling of the best of all they have learned — each has made its greatest gain.

The Elgin-Refinite man has something *new* for you —something he did not have as an Elgin man or as a Refinite man. He has something new in products and viewpoint that enable him to give you the most direct, effective, economical solution to *ANY* water conditioning problem. The coupon provides a convenient way to ask for the Elgin-Refinite solution to your problems.

ELGIN-REFINITE, INC.

A DIVISION OF ELGIN SOFTENER CORPORATION, ELGIN, ILL.

REPRESENTATIVES IN PRINCIPAL CITIES

The Most Comprehensive and Authoritative Line
Typical of the broad scope of Elgin-Refinite products are chemical feed systems, zeolite softeners, ion-exchange systems including deionization, lime-soda softening, deaerating heaters, filtration equipment of all types including diatomite filters, and swimming pool equipment. Chances are that one of these systems will fit your water conditioning needs. But whatever your need, we can "tailor" any type of system to produce water of the exact characteristics you require.

IN CANADA: G. F. STERNE AND SONS, BRANTFORD

SEND FACTS ABOUT: ☐ Water Softeners; ☐ Clarifiers; ☐ Filters; ☐ Deionizers; ☐ Deaerating Heaters; ☐ Chemical Treatment. ☐ Swimming Pool Equipment.

Water Conditioning for: ☐ Boilers; ☐ Processing; ☐ Waterworks; (If you have other needs attach note)

☐ Hurry ☐ Take Your Time ☐ Send Representative

Name_____

Company_____

Street_____

City_____ Zone____ State_____

Mail to Elgin-Refinite, Inc., 138 North Grove Ave., Elgin, Ill.

Circle 524 on Reply Card for more data

new bulletins

. . . catalogs from leading manufacturers

200—Pipe Insulation

What you would like to know about Kaylo heat insulation—physical characteristics, possible applications, K factors standard sizes, thicknesses and forms, recommended thicknesses, and insulation efficiencies—is covered in an 8-page bulletin. The story of pipe insulation and heat insulating blocks is told by means of photographs, graphs, and charts. Owens-Corning Fiberglas Corp.

201—Tank Insulation

"Foamglas, the Long-Life, All-Temperature Insulation for Tanks and Other Equipment," should prove a useful reference for engineering and maintenance personnel. Physical properties of the cellular glass insulation, sizes and shapes available, and recommended thicknesses required for temperatures ranging from -50 to 800 F are included with condensed suggested specifications and photographs of applications. Pittsburgh Corning Corp.

202—Metalizing

The Sprayweld Process for fast, low-cost hard-surfacing is described in 4-page folder 53B. Typical application of Metco-Weld H such as on acid sludge-pump rods and agitator shafts is pictured. Metallizing Engineering Co., Inc.

203—Welding Pad Gage

Built to be welded directly onto a tank or other liquid containing structure, welding pad gages described in data sheet 205 are the answer to installations where there is solid matter in the vessel or where the thermal error of a gage glass would be high. Cross-sectional drawings show the design of both the reflex and circular type. Jerguson Gage & Valve Co.

204—Combustion System

Greater heat transfer, soot-free boilers, and the answer to the costly slag problem are accomplishments claimed for the Radiant Combustion System for burning heavy fuel oil. A 4-page folder explains operation of the system and its advantages. Radiant Combustion System, Inc.

205—Combustion Processes

Too much or too little air can have costly effects in combustion processes. Bulletin "Oxygen-Index of Combustion Processes" points out that by using oxygen itself as the criterion to proper combustion, greater over-all efficiency, and more economy can be realized. Sample point location and equipment requirements are discussed. Arnold O. Beckman, Inc.

206—Vertical Unit Boiler

More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Various possible installations are shown by photographs and cross-sectional drawings. Combustion Engineering, Inc.

207—Pressure Relief Valves

"Selection and Sizing Pressure Relief Valves to Comply With ASME Boiler Code Requirements," a 24-page booklet published as a contribution to the heating industry, provides complete and easy-to-use data for accurately determining the output of all types of boilers, tanks, and heaters. Formulas and tables cover recommended relief valves for cast-iron and steel boilers, as well as those boilers for which there is no nameplate data or set procedures for establishing the output. McDonnell & Miller, Inc.

208—Fuel Systems

Over 50 years of experience in steam generation backs up 29-page bulletin "Pulverized Fuel Systems." Well illustrated with cross-sectional drawings and graphs, it gives advantages, typical installations, and descriptions of major operating parts. Foster Wheeler Corp.

209—Spreader Stokers

Spreader stokers said to be adaptable to all types and makes of modern steam boilers and generators, from 5000 to 75,000 lb per hr steam output capacity, are described in 14-page brochure 800. Various installations using Roto Stoker Type CC are highlighted by means of cross-sectional drawings and photographs. Detroit Stoker Company.

210—Remote Miniature Indicators

Construction, installation, and design features are described in 12-page bulletin 55-10. Photographs show construction of bellows spring assembly and details of other components. The incorporation of various types of warning devices in the instrument is also explained. Space requirements for panel mounting are given as well as specifications for range of operating air pressures, scale types, graphic color guides or alarms, accuracy, and alarm switches. Fischer & Porter Co.

211—Induction Motor Standards

New NEMA standards for 1 to 40 hp induction motors have been published in 7-page bulletin 1600. A comparison of the principal dimensions of the old and new NEMA frames is included in table form. The Louis Allis Co.

212—Heavy-Oil Burners

Booklet 175-G, 8 pages, describes in detail the outstanding design and construction features of both the Model B oil, and the Model BR oil-gas burners, including dual-pump reservoir, fuel regulator, high-speed belt-drive, precision air-oil control, sure-fire ignition, fuel feed to atomizer, and extra long nozzle. Complete specifications, computed at 70 percent thermal efficiency, are given for both types. Preferred Utilities Manufacturing Corp.

213—Motor Starters

"Type H Motor Starters," 12-page bulletin 14B6410B, carries schematic wiring diagrams of typical control methods. Operation and make-up of air and oil contactors is explained for starters with ratings up to 3000 hp at 5000 v. Allis-Chalmers Manufacturing Co.

214—Oil-Immersed Starters

For use in corrosive or hazardous-gas locations, these oil-immersed starters for low-voltage motors are said to offer accurate motor protection and easy maintenance. 8-page bulletin GEA-3541 explains these features and also gives ratings and dimension diagrams. General Electric Co.

215—Circuit-Breaker Panelboard

A plug-in panelboard (Type NPLAB) that will cut job time and costs for your lighting and appliance branch circuit applications is described in booklet B-5644. Features discussed include plug-in breakers, snap-on covers over neutral bar and main lugs, and positive trip identification when breaker opens automatically. Westinghouse Electric Corp.

216—Gate Valves

Pioneers in the manufacture of valves for nearly a century, this company has issued 4-page circular 561 describing its complete line of all-iron and iron-body, bronze mounted Kingclip gate valves. Specification data and leading dimensions are given. The Lunkenheimer Co.

217—Control Valves

Condensed catalog 531 describes the Quick-As-Wink line of air and hydraulic control valves and valve couplings by means of sectional views of body, plunger, packing, and interior operation. It also lists sizes, actions, permissible pressures, and temperatures. C. B. Hunt & Son, Inc.

218—Variable Speed Drive

Gyrol Fluid Drive, Type VS, Class 4, is described, part by part, in 24-page bulletin 9319. Useful to engineers interested in adjustable speed operation in the 100 to 2500 hp range are constant and variable torque charts, and a speed reduction factor table. Sample problems illustrate use of the charts. American Blower Corp.

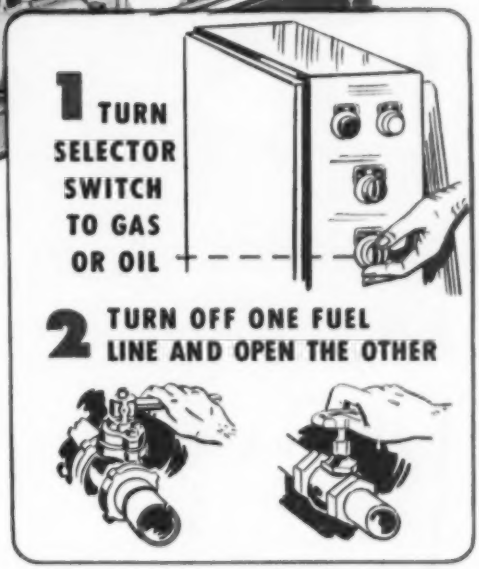
219—Electric Plants

The "Blue Book," 34-page pocket-size booklet describes in easy-to-understand language the 3 general groups of electric

NOTE — Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on reply card between pages 114 & 115.

NOW... interchange Gas and Oil firing in *10 seconds*

Modern Cleaver-Brooks Model LR Steam Boiler Equipped with Exclusive Cleaver-Brooks "10-second conversion" Combination GAS and/or OIL Burner



TWO, simple motions eliminate time-consuming change-over

Now you can use oil or gas at the flick of a switch! This exclusive new Cleaver-Brooks development permits changeover from oil to gas or vice versa in only 10 seconds.

That's because the Cleaver-Brooks Combination Gas and/or Oil Fired Boiler operates on gas *with the oil burner in place.* Simply flipping a selector switch on the control panel to either gas *or* oil sets the proper circuit in action. Turning the convenient fuel supply valves completes the entire changeover — and in 10 seconds or less!

To gas users in all parts of the country — and in particular areas where local requirements demand immediate changeover — this exceptional fuel flexibility can be an important factor in determining your overall operating economy.

Ten-second conversion, like 4-pass construction, self-contained design, guaranteed 80% efficiency, is another "plus" feature pioneered by Cleaver-Brooks. It demonstrates Cleaver-Brooks' continuing effort to bring steam users even greater flexibility and reduced operating costs.

If you are considering simplifying your present boiler plant, remember Cleaver-Brooks Combination GAS and/or OIL Fired Boilers. Sizes 15 to 500 h.p. — 15 to 250 p.s.i. Write for complete facts.

Cleaver-Brooks

Originators of the Self-Contained Steam Boiler

CLEAVER-BROOKS COMPANY

Dept. M-303 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

Circle 525 on Reply Card for more data

NOW

Roll tubes into thick tube sheets automatically! . . . from the inside out! with the

NEW AIRETOOL RETRACTIVE EXPANSION SYSTEM

Advantages? *just check them!*

- √ Draws tube metal toward mouth, eliminates inward elongation.
- √ Each joint rolled automatically to predetermined tightness.
- √ Eliminates slow, costly steprolling.
- √ Continuous process rolling shortens rolling time.
- √ Tube sheets protected against distortion, enlargement of holes.

With this new Retractive Method of Tube Expansion, the expander is fully inserted and rolls a short section of the tube. When full expansion is reached, it then automatically starts to retract. Keeps rolling as it retracts, gives full expansion to the tube the entire thickness of the sheet.

To learn more about this efficient new Retractive Method of expanding high pressure tubes—write for your copy of AIRETOOL Bulletin No. 54.

AIRETOOL MANUFACTURING COMPANY

SPRINGFIELD, OHIO

There's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction.

Branch offices: New York • Chicago • Philadelphia • Tulsa • Baton Rouge • Houston • Hudson Heights (NJ)

Representatives in principal cities of U.S.A., Canada, Mexico, South America, England.

Circle 526 on Reply Card for more data

new bulletins

—Starts on page 36

plants: ac, dc, and battery charging. Cost of operation and installation for the 3 types of prime movers, gasoline, diesel, and gas engines is discussed along with a concise summary of important points to remember in selection of a generating plant. D. W. Onan & Sons, Inc.

220—Rayon Belting

Transmission belting with rayon instead of cotton plies was proved in field applications for more than 4 years on jobs specially selected for their severity according to 4-page folder A5163K. Uses and advantages of the several types of Thor belting are listed. Goodyear Tire & Rubber Co.

V-Belt Drives

Compiled for graduate engineers, as well as for maintenance supervisors and purchasing agents, 52-page V-belt manual presents in a simple, clear manner all elements of V-belt drives. Complete with tables, graphs, and diagrams, it includes the new V-belt industry numbering system and the numbering system of each major manufacturer in the field. **Please send requests directly to Boston Woven Hose & Rubber Co., Dept 609-26, P. O. Box 1071, Boston, Mass. on company letterhead.**

221—Belt Conveyors

"Barber-Greene Conveyors," 60-page catalog 764 emphasizes the economy, utility, and simplicity of belt conveyors. Each component and accessory is illustrated and described with line drawings showing relationship of the unit to the entire conveyor. In addition, range of application of each item is tabulated for quick reference. Barber-Greene Co.

222—Electrode-Selector Chart

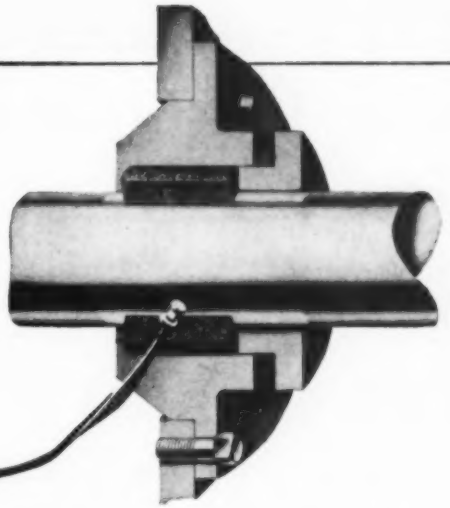
A new four-page electrode-selector chart, designated GEC-657E, presents up-to-date information on the complete line of G-E welding electrodes. It contains condensed data on the company's mild-steel, low hydrogen—low alloy, low alloy-high tensile, hard-surfacing and stainless-steel electrodes. Tabular material includes welded properties, metal deposit analysis, technique, type of specification requirements met, major competitive types, description and advantages, and application data for each type of electrode listed. General Electric Co.

223—Welding

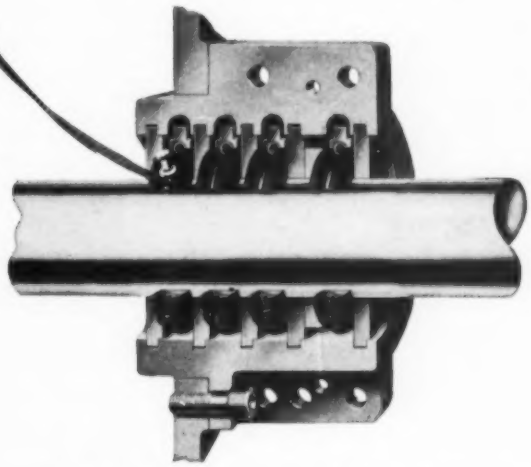
Everything you want to know about "The Welding of Nickel Alloy Steels," is contained in this 44-page handbook, A-93. A study of the various welding techniques, including some of the newer inert gas processes, electrodes, preheat treatments, and post heat treatments, it gives the

COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .

WRITE FOR BULLETIN 135
COPPUS ENGINEERING CORPORATION
191 Park Avenue
Worcester 2, Mass.
Sales offices in
THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

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You Get Trustworthy Liquid or Gas Cooling With Great Cooling Water Savings from the NIAGARA AERO HEAT EXCHANGER

● You can cool air, gas, water, oils, chemicals, electric and power and process equipment, engines, mechanical processes with lower cost and really accurate control of temperature with the Niagara Aero Heat Exchanger.

You are assured of uniform, constant production and quality from any process . . . steady, reliable operation . . . lower cost for more dependable cooling. You can have closed system cooling with freedom from scale, dirt, corrosion and maintenance troubles. You can accurately cool more than one type of liquid with one machine.

The Niagara Aero Heat Exchanger uses atmospheric air to cool liquids and gases by evaporative cooling. You can remove heat at the rate of input to keep accurate control of gas or liquid temperature. You can put heat back into the system to save the losses of a "warm-up" period or to equalize the effect of load variations.

Great savings in cooling water and savings in piping, pumping and power return the cost to you quickly. The Niagara Aero Heat Exchanger can save you approximately 95% of your cooling water cost. Write for Bulletin 120.

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. IP, 405 Lexington Ave. New York 17, N. Y.

Experienced District Engineers in all Principal Cities of U. S. and Canada

Circle 528 on Reply Card for more data

new bulletins

—Starts on page 36

typical results that can be expected for the low alloy high strength steels, low carbon and medium carbon engineering alloy steels, and special steels. International Nickel Co., Inc.

224—Pipeline Expansion Joints

All the basic data necessary to the proper selection and application of pipeline expansion joints are presented in 8-page bulletin 133. Highlights of the bulletin include a discussion of types of pipeline motion frequently encountered, and methods of handling this motion, complete specifications for low and high pressure units, and detailed information on special types of joints including Flexoniflex, good for pressures to 5500 psi. One section deals with guiding and anchoring of expansion joint installation. Flexonics Corp.

225—Metal Hose and Conduit

Engineering data on frictional losses versus flow rates for various sizes of metal hose and conduit are incorporated in 50-page catalog 200 along with aids on installation and care of Titeflex and Uniflex flexible hose. Titeflex, Inc.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pages 114 and 115. Your requests will be handled promptly.

226—Masonry-Surface Coatings

A New 8-page brochure, "Bakelite and Vinylite Resin Coatings for Masonry," gives outstanding advantages, varied applications, and results of actual service tests. Coatings described are applicable to concrete, stucco, cinder block, brick, plaster, and porcelain surfaces. They are resistant to varying weather conditions as well as most acids, alkalies, and other chemicals, and to food stuffs, oils, and greases. They can be applied by spraying, brushing, or roller-coating. Bakelite Co.

227—Metal Cleaning

Illustrated by appropriate graphs and diagrams, a 4-page technical folder describes in detail the principles and methods used in the application of ultrasonic energy for the cleaning of metal parts. The Soniclean process is described as a combination of the solvent degreasing cycle and the application of ultrasonic energy to produce precision metal cleaning. Detrex Corp.

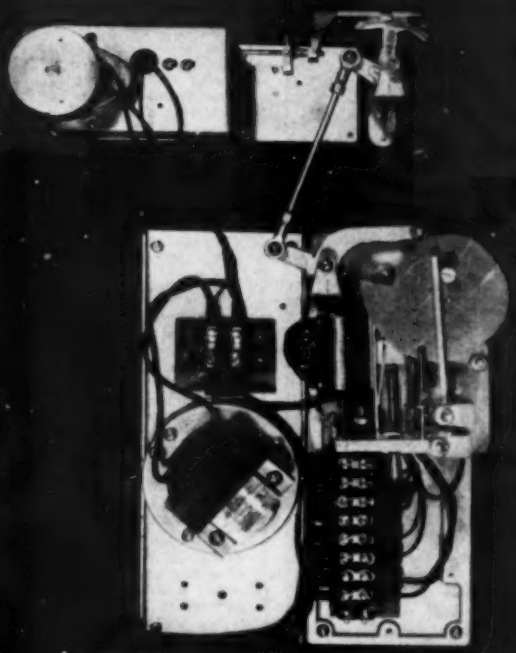
228—Vertical Pump Motors

Bulletin 1250 shows various types of enclosures available and illustrates many varied uses for hollow and solid shaft vertical pump motors in industry. Several four-color cutaway illustrations and phantom drawings show details, including types of oil and grease lubricated thrust bearings available and special construction features. Louis Allis Co.

229—Centrifugal Pumps

Wide interchangeability of parts for Class CNTA multi-stage centrifugal pumps is featured in a 2-page foldout chart in bulletin 7251, 18-pages. Cutaway and dimensional drawings show how the design

a new electronic flow meter!



continuous integration —no creep at zero

unaffected by normal voltage, frequency and temperature changes

electronic operation provides high speed and greater accuracy

3 to 1 range calibration at recorder

HAYS Electronic Flow Meter

Since the circuit is of the electronic null-balance type, it is unaffected by normal voltage and frequency variations. Also, neither temperature variations nor reasonable length of transmission lines affect the calibration of the instrument.

The *pen-drive motor* is built for reversing duty. Normal variations in voltage and frequency have no noticeable effect on its operation.

The *integrator* is continuous in operation and simple in mechanical construction. A micrometer zero adjustment for calibration is easily accessible.

Indicators can be calibrated to read directly in rate-of-flow or other factors as desired.

Write today for full information on the Hays Electronic Flow Meter Bulletin 52-1074-222.

Automatic Combustion Control
Boiler Panels
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

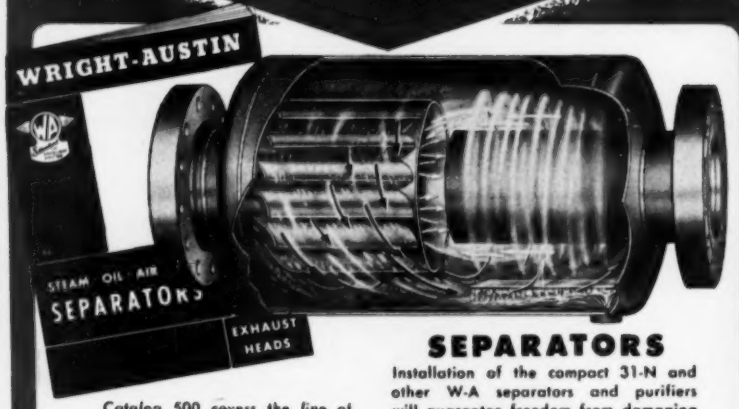
THE hays CORPORATION

MICHIGAN CITY 2, INDIANA

Circle 529 on Reply Card for more data

LOW COST PROTECTION for EXPENSIVE EQUIPMENT

WA Standard with STEAM USERS SINCE '94



Catalog 500 covers the line of separators, purifiers, exhaust heads for steam, air and gas.

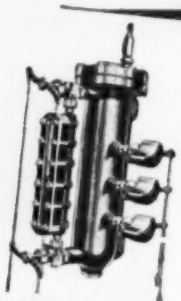
SEPARATORS

Installation of the compact 31-N and other W-A separators and purifiers will guarantee freedom from damaging entrainment, oil, rust, scale and condensate in your power lines.

STEAM TRAPS

Operation of W-A traps is simple, fool-proof. Installation has been made easy and service can be performed with minimum effort and time.

Catalog 600 describes the wide range of W-A traps for steam, air and gas.



BOILER TRIM

Provisions for greater safety to equipment and worker plus peak efficiency is available at low cost in this line of 16 accessories.

Catalog 700 describes the complete line of alarms, gauges, controls, etc.

WA WRIGHT-AUSTIN COMPANY WA

3245 WIGHT STREET • DETROIT 7, MICH.

Circle 530 on Reply Card for more data

new bulletins

—Starts on page 36

of these motors makes them specifics for boiler feed, refinery, process work, and mine pumping services at pressures above 300 psi. Ingersoll-Rand Co.

Cable Accessories

Publication No. C-79-13-14 is a combination of Sections 13 and 14 of Anaconda's General Catalog No. C-79. It contains pertinent information on potheads, filling compounds, paints, and allied items with complete discussion of their features, applications, and installation information. Catalog also includes data on joints, connectors, rolling tools, drawbenches, tie wire, armor rods, and accessories for ACSR and steel ground wire. **Please send requests directly to Fred Luna, Director of Sales Promotion, Anaconda Wire & Cable Co., 25 Broadway, N. Y. 4, on your company letterhead.**

230—pH Control

"Automatic pH Control in water and Industrial Waste Treatment," 8-Page booklet, is a reissue of a paper delivered by R. T. Sheen, president of this company. Outlined are several typical systems of automatic pH control in boiler feed water treatment, using air- and motor-operated valves as well as controlled volume pumps to effect proper addition of chemicals. Diagrams of actual installations illustrate the bulletin. Milton Roy Co.

231—Water Clarification

Major advantages of the solids contact principle for clarifying and lime softening of water, and basic requirements for sound solids contact reactor design are incorporated in 24-page bulletin 5001-A. It illustrates the basic reactor types that can be supplied by this company—round or square units with vertical shaft agitator, and rectangular units with horizontal shaft agitator. Reactors can be made of concrete, steel, or wood or combinations of these materials. Chemical feed and auxiliary equipment are described. Cochrane Corp.

232—Water Sampling

Are you sure you know the which, when, and where of obtaining samples for proper control of water conditions in your power plant? "Effective Water Sampling," folder 28X7969, gives concise information on each phase of water sampling. Allis-Chalmers Manufacturing Co.

233—Dry-Type Panel Filters

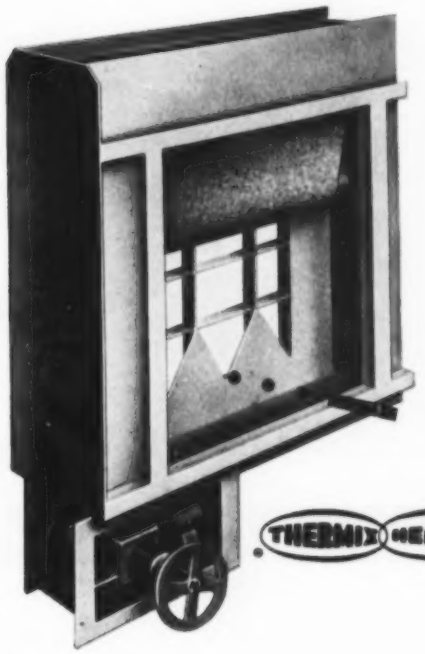
Ventilation and air conditioning engineers will find in 8-page bulletin 600, useful graphs and charts covering performance, installation, and selection data on Staynew ventilation and air conditioning dry-type panel filters. Formulas are given for solving installation problems by means of the graphs. Dollinger Corp.

234—Hoisting Equipment

"There's a Yale Hoist for Every Lifting Job," 12-page booklet 1567 won first award for advertising excellence at this year's Triple Industrial Supply Convention. Differential, screw gear, and spur geared hand hoists are compared for relative efficiency and initial costs. A check chart shows at a glance which hoist features are incorporated in four types of electric hoists. Also shown are typical applications for the Pul-Lift, a versatile tool which can be used for either pulling or for lifting jobs. The Yale & Towne Mfg. Co.

(Continued on page 118)

Only a Heacon Damper offers you this



"V" The V that gives you accurate control in the lower flow increments

Heacon Dampers provide the only solution to accurate flow control. With a background of over a decade of application to specialized problems, Heacon Dampers are accepted by engineers as the only means of accurate flow control, particularly in the lower flow increments.

V-porting is the secret. Heacon Dampers may be designed with V-porting to produce practically any flow characteristic from zero to 100%. With conventional dampers barely cracked, a flow of 10 to 20% or more is immediately released with resultant flow control problems in the entire system.

Heacon Dampers are a radical departure from normal damper construction. Consisting of supporting grill, sealing strip and flexible curtain of woven blue asbestos, metal or other suitable material as determined by the application, Heacon Dampers are recommended for use where these two factors, among others, are of major importance:

1.—Accurate control and ease of operation by either manual or mechanical means.

2.—Positive, tight seal when damper is closed.

The Thermix Corp., Project Engineers for Heacon Dampers are specialists in the application of this damper to your particular requirements. Why not call their engineers today.

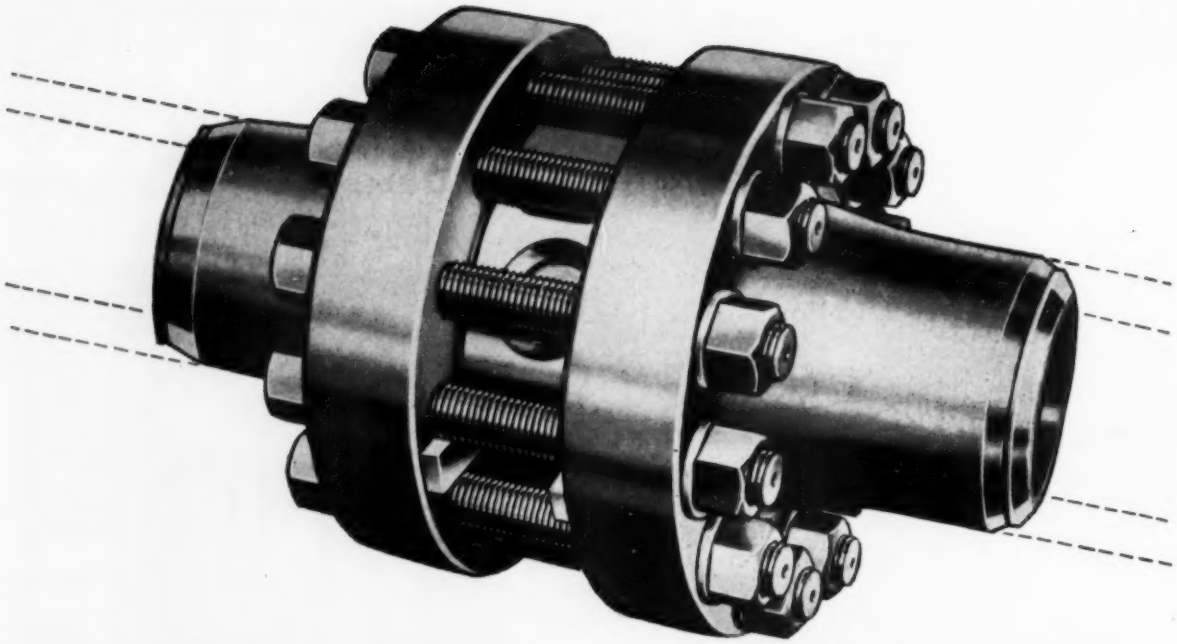
Project Engineers

THE THERMIX CORPORATION
GREENWICH, CONN.

(OFFICES IN 38 PRINCIPAL CITIES)

Canadian Affiliates: T. C. Chown, Ltd. 1440 St. Catherine St. W., Montreal 25, Quebec. 983 Bay St., Toronto 5, Ontario, Canada

Circle 531 on Reply Card for more data

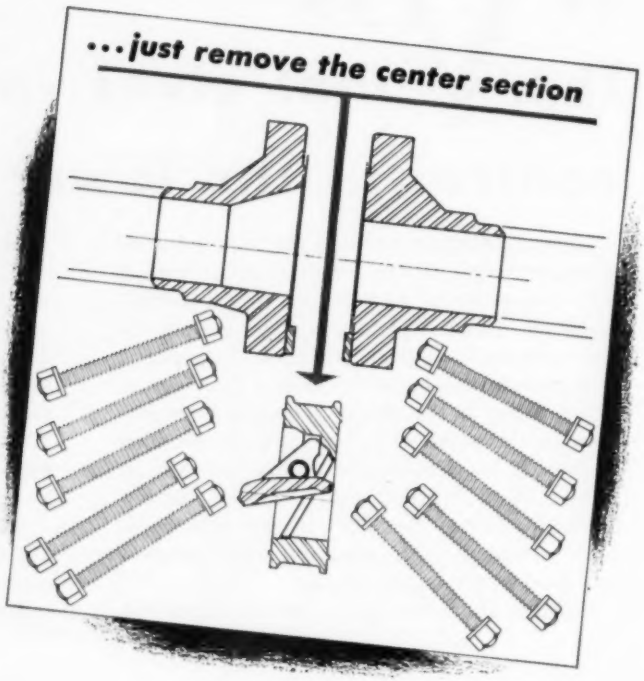


NO NEED to cut this valve out of a Welded Line

...it's a CHAPMAN 3-PIECE TILTING DISC CHECK VALVE

Remove studs between inlet and outlet ends. Then the whole center section can be slipped out *as a unit* . . . and quickly and easily replaced. Figure the savings for yourself!

Here, Chapman design gives you the smooth operation and quiet closing of the 2-piece Tilting Disc Check Valve . . . with the unique advantage of practically immediate interchangeability of "the works." And *only* Chapman makes this complete line of Tilting Disc Check Valves. Send for your Chapman "Check Book" — *now!*



The Chapman Valve Mfg. Co.

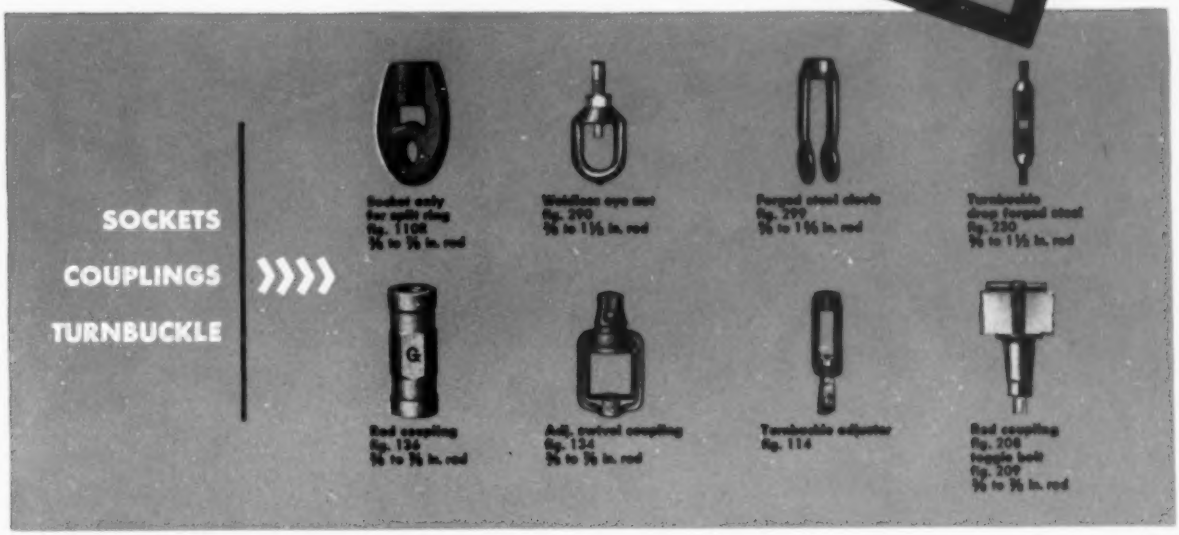
INDIAN ORCHARD, MASSACHUSETTS

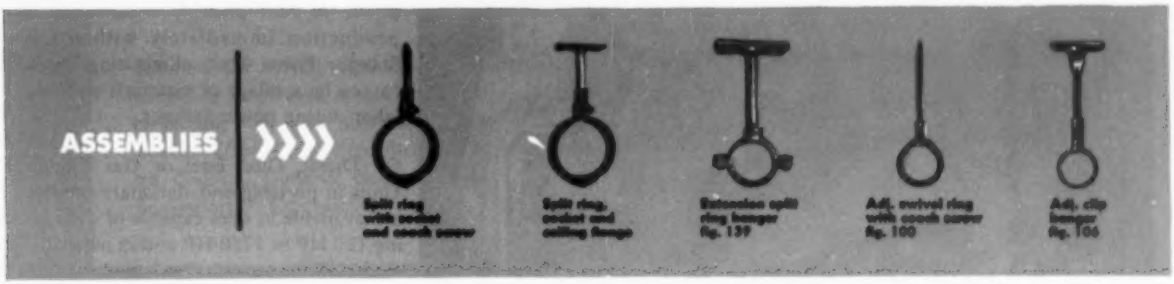
Circle 532 on Reply Card for more data

ADJUSTABLE PIPE HANGERS AND SUPPORTS

for every piping requirement

NO. 5 OF A SERIES SHOWING THE GRINNELL LINE





Call your local Grinnell Distributor, or write for Hanger Catalog.

GRINNELL

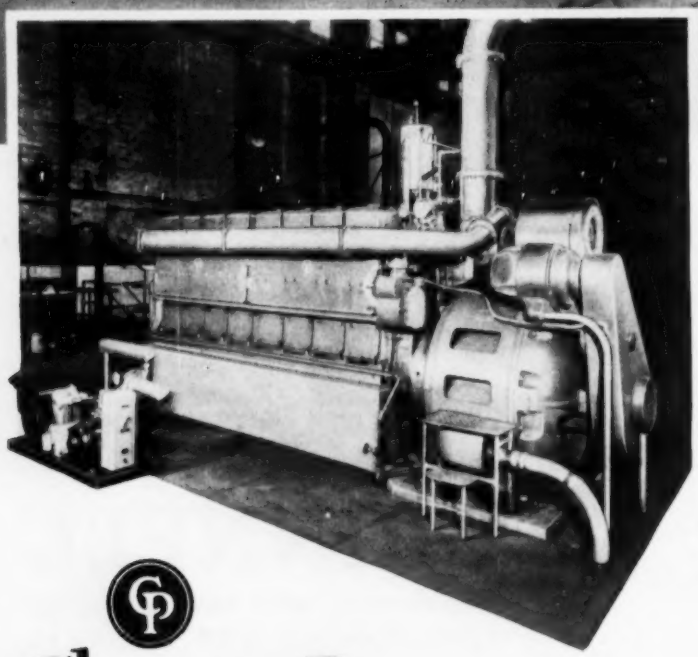
AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

Circle 533 on Reply Card for more data

PERFECT "STAND-IN" WHEN POWER FAILS



When an emergency strikes, cutting off power in your plant, you can resume production immediately with a CP Standby Power Unit, eliminating losses caused by spoilage of materials and idle labor during power failures.

CP Diesel, Dual Fuel or Gas Engine Units in portable and stationary models are available in sizes capable of delivering 120 HP to 1750 HP and in normally aspirated or supercharged models. For more details, write: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Circle 534 on Reply Card for more data

The New G-E WHITE Rigid Steel Conduit

Zinc galvanized by the "metallizing" process for improved corrosion resistance and easy bending.

New corrosion-resistant interior lacquer contains antifriction agent for easy fishing and wire pulling.

The new G-E WHITE rigid steel conduit is available in all size mixes. For more information, see your distributor or write Section C36A-1144, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

GENERAL ELECTRIC

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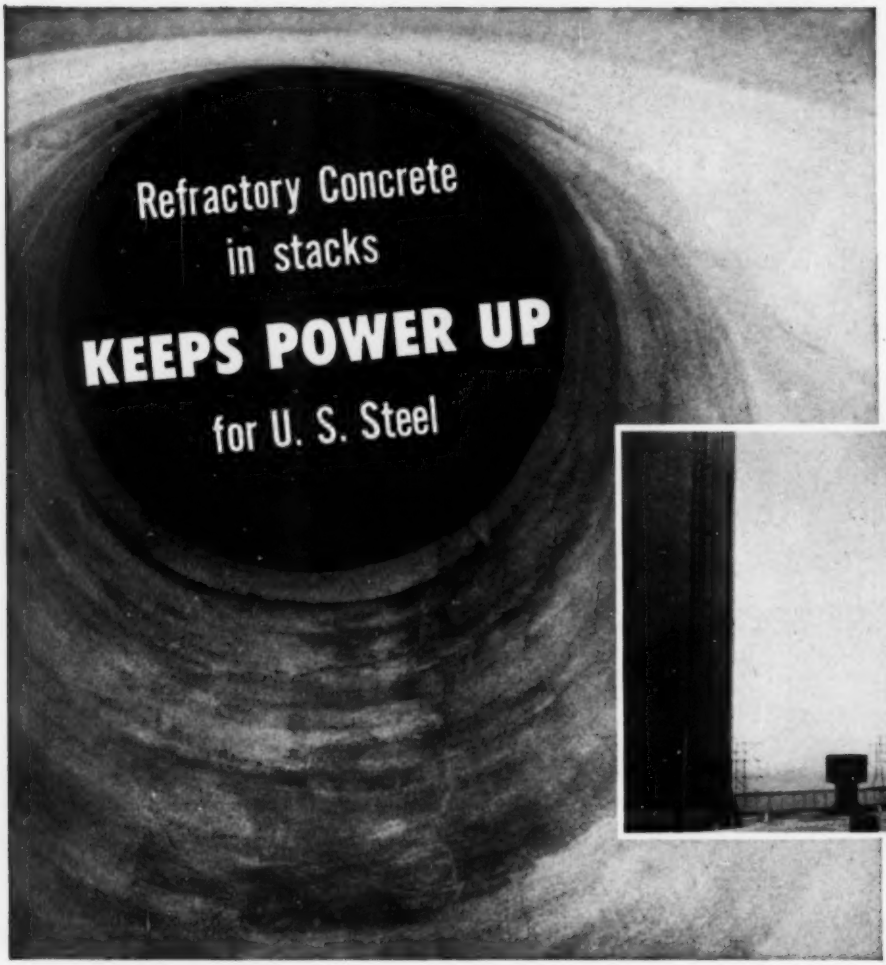
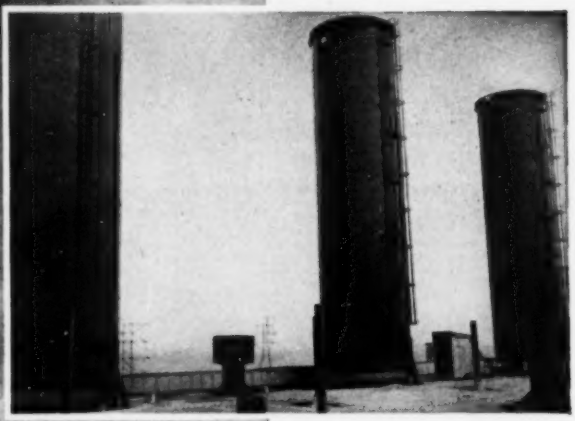




FAST WORK—Each 14′ 10″ i.d. x 61′ 6″ high stack got a 2½″ lining of Refractory Concrete in just 4 days after reinforcing wire mesh was attached. Concrete made with Lumnite Cement and traprock was "shot" on by cement gun.

You're looking down

the smooth, jointless Refractory Concrete lining that protects a power stack at the new Fairless Works. It's the way U. S. Steel assures long, trouble-free stack life. Here's why:

Saves time. Fast, monolithic construction is further speeded by the ability of Refractory Concrete made with Lumnite* Cement to reach service strength in 24 hours or less! *Helps draft.* The one-piece lining prevents "breathing." *Gives long-lasting protection.* Lumnite-made Refractory Concrete resists attack of sulphurous gas and abrasive fly ash, takes heat to 2600°F, has low volume change and withstands thermal shock.

Whether you're lining or rebuilding a stack, it will pay you to look into the enviable record of Refractory Concrete made with Lumnite calcium-aluminate cement—in power, metals and refining industries . . . in fact, wherever heat, corrosion or abrasion are problems.

FOR CONVENIENCE, you may prefer to make Refractory Concrete with prepared castables (Lumnite Cement plus aggregates selected for specific temperature and insulation service—add only water). They're made by refractory manufacturers and sold through their dealers. For more information, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

*"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.

IP-L-74R

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

Circle 536 on Reply Card for more data

NONPAREIL
TRADE MARK
Turbine Oil

Here's powerful evidence of the benefits offered by . . .

■ Since 1940, the Indianapolis Power and Light Company has put NONPAREIL Turbine Oil into one new turbine after another. Today, this rapidly growing company has eight big turbines—with 363,000 KW capability—operating on this unique lubricant.

During the 13 years it has been in use, NONPAREIL has provided convincing evidence of its ability to eliminate oil replacements and oil-system cleaning. None of the original fills of NONPAREIL have needed to be replaced. Neutralization numbers have stayed below 0.07 mg. KOH/gm. Oil systems have remained entirely clear.

The lubricant and maintenance savings realized by this utility are just the beginning. Trouble-free lubrication and consequent savings are *assured for the life of the eight turbines* in normal operation. This is based on the written guarantee, given with each fill of NONPAREIL, that this outstanding lubricant will last as long as the turbine, and that its neutralization number will stay below 0.15 mg. KOH/gm.

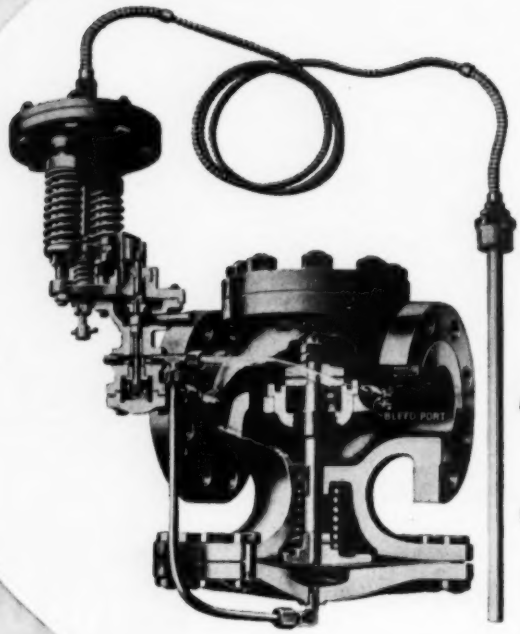
The Standard Oil lubrication specialist serving your section of the Midwest will be glad to show you lubrication records of NONPAREIL in installations similar to your own. These records cover up to 25 years' continuous operation of individual units on original fills of oil. You can contact this specialist by phoning your local Standard Oil Company, 910 South Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD *(Indiana)*

Circle 537 on Reply Card for more data

3 Reasons for Accurate Regulation



PACKLESS CONSTRUCTION

LARGE BALANCED METAL DIAPHRAGM

SENSITIVE PILOT

Spence

Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

SE128

SPENCE ENGINEERING COMPANY, INC., Walden, New York

Circle 538 on Reply Card for more data

NEW BOILER WATER CONDITIONING PACKAGE

Adjust-O-Feeder
Model 1105-S

- **LOW COST**
- **COMPACT**
  Built-in standard motor — no separate gearbox or couplings.
  Built-in oil-enclosed gear reducer.
- **MICRO-STROKE ADJUSTMENT**
  Scale easily read — crank and connecting rod operate in horizontal plane.
- **LONG LIFE AND EASY MAINTENANCE**
  One-piece Meehanite iron frame for positive alignment of all moving parts.
  Double check valves on suction and discharge easily removable.

This new, compact chemical feed pump, by %Proportioneers, Inc.%, is inexpensive and provides accurate boiler water treatment for plants where a low capacity, medium pressure pump will meet requirements. The standard Model 1105-S has a capacity range from 1 to 10 GPH and will discharge against pressure up to 650 psig. For lower feeds, the unit is available with a range of from 0.5 to 5 GPH. Complete and self-contained, Model 1105-S weighs less than 100 lbs. and is ready to operate.

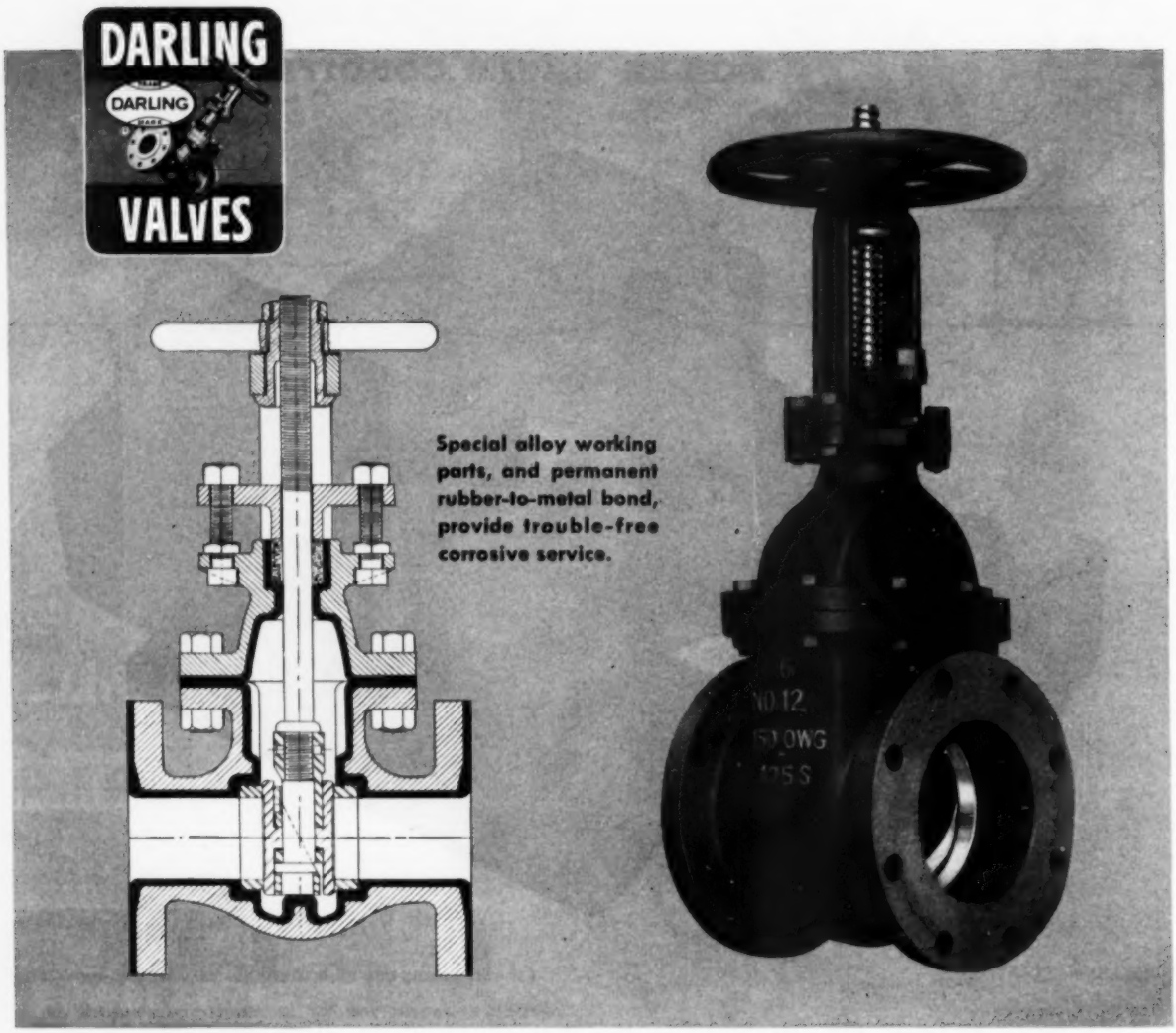
Ask for Bulletin 1105

% PROPORTIONEERS, INC. %

Write to %PROPORTIONEERS, INC.%, 357 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

Circle 539 on Reply Card for more data



Meeting the "Acid Test" the low-cost way with DARLING rubber lined iron body valves!

YOU can save dollars by installing Darling rubber lined, iron body gate valves for corrosive services up to 150°F. These Darling gate valves are giving outstanding service in job after job.

You Get This Plus Value Too!

The *fully revolving double disc,* parallel seat principle compensates automatically for valve body distortion. Tight closure is assured every time. And wear on working parts is *uniform.*

In plant after plant Darling rubber lined, revolving disc, parallel seat gate valves are setting records of efficiency and economy. These unique rubber lined valves are made in rising stem, cylinder, motor-operated, or quick-opening types. Ask for the special Darling rubber lined *gate* and *check* valve bulletin.

VALVES FOR EVERY NEED

Darling also offers gate valves in a wide range of sizes, types and construction for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds.

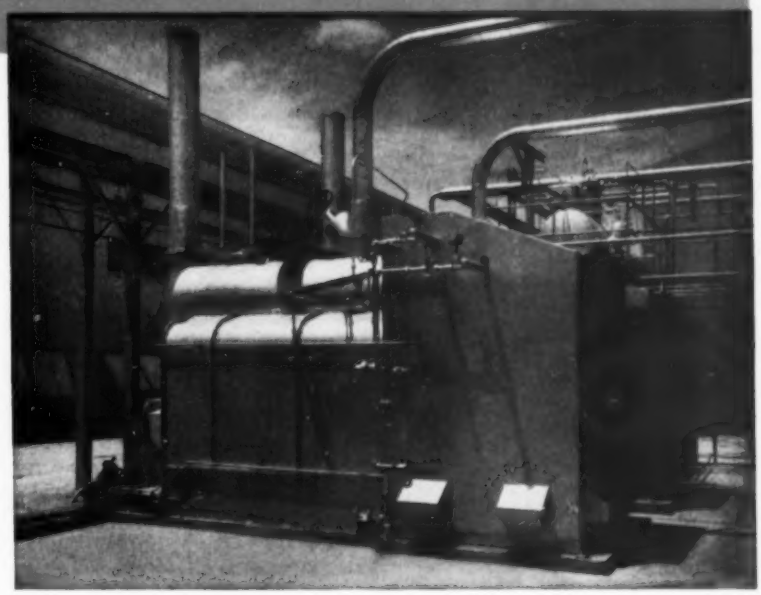
DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt, 19, Ontario

Circle 540 on Reply Card for more data

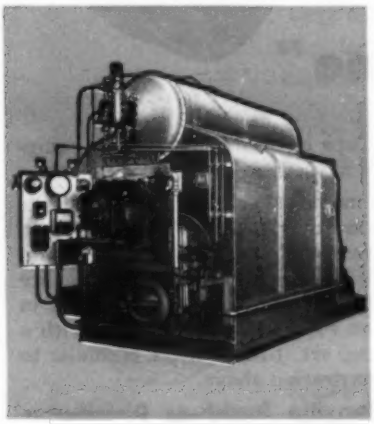
REYNOLDS METALS CO.
uses 2-Erie City KEYSTONES at SAN PATRICIO PLANT



THESE TWO gas-fired, 5000 pounds-of-steam-per-hour Keystone Steam Generators are installed outdoors. They generate steam for process at one of the largest aluminum plants in the world. Firing equipment is protected from the elements by ventilated shelters.

REYNOLDS METALS CO.
SAN PATRICIO PLANT
CORPUS CHRISTI, TEXAS

KEYSTONES *make steam where you use it*



KEYSTONES—2-drum water tube boiler-furnaces, are completely assembled and wired at the factory and may be installed indoors or outdoors—as close to steam application as practical. They need only to be service connected, and because they are push-button operated require only part time supervision. Electronic operational and safety controls provide for smooth, efficient and dependable service. Keystones are designed to operate with gas and/or oil at approximately 80% efficiency. Keystones are available in capacities to 30,000 pounds of steam per hour—in a wide range of operating pressures.

For complete data ask for Bulletin SB-38

You can depend on Erie City for sound engineering

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

Circle 541 on Reply Card for more data

Trying to reduce piston packing maintenance?

J-M Pump Cups after removal from feed water pumps at Morgan Laundry. Set above consists of 2 J-M "A" Cups with spacer and 2 followers, mounted on pump rod

At the Morgan Laundry, J-M Moulded Packings provide

"8 times longer life– replacement in 1/6 the time"

THE MORGAN LAUNDRY, large supplier to hotels and institutions, requires dependable, trouble-free service from boiler room equipment. In their New York City plant, the Engineering Department found that conventional piston packings for boiler water feed pumps lasted only a relatively short time. Many hours of down time were required to replace packings. Liner wear became progressively worse.

When the Engineering Department changed from the conventional material to J-M Moulded Packing Cups, service life of the packing was increased more than 8 times. Liner wear was greatly reduced. Replacement with the new packings was made in 1/6 the time. Packings could be easily installed for proper service, without special skill or experience. Satisfaction with this application has led to the use of J-M Moulded Packing Cups on other boiler room equipment and on presses in the Morgan Laundry plant.

These precision moulded packings offer definite advantages over conventional types. Because they form a highly efficient seal, they contribute to improved performance, lower operating and maintenance costs. For steam pump pistons, they are available in sets consisting of two cups and two followers, with a spacer. This pump cup set, J-M Style 80, is similar to that shown in the illustration above.

Your Johns-Manville Packings Distributor can help you make the right selection for your application, from Johns-Manville's line of custom-made Piston Packing Cups. For complete details write him or Johns-Manville, Box 60, New York City 16. In Canada, 199 Bay Street, Toronto 1, Ontario.

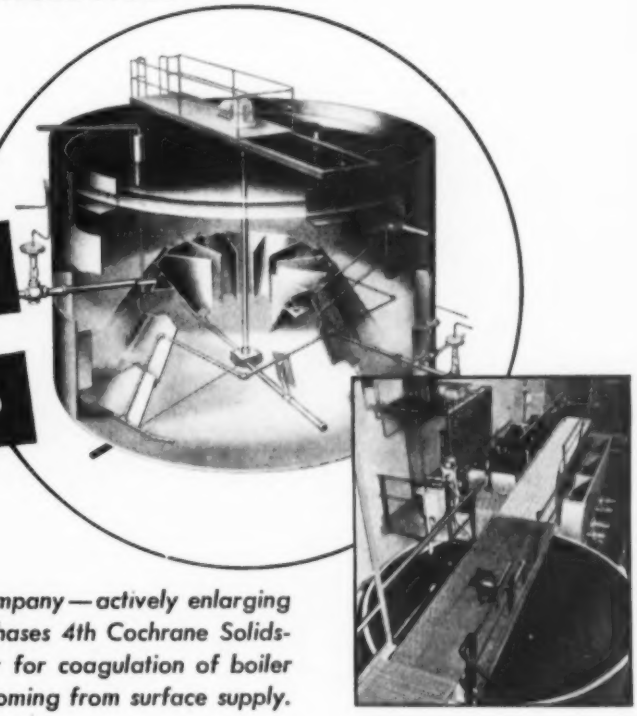
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

Circle 542 on Reply Card for more data

COCHRANE WATER CONDITIONING
STARTS WHERE NATURE STOPS

REPEAT ORDERS FOR COCHRANE REACTORS



Duke Power Company — actively enlarging capacity — purchases 4th Cochrane Solids-Contact Reactor for coagulation of boiler feed make-up coming from surface supply.

• This record of repeat orders is evidence of successful design and performance. Units are being built for coagulation, lime softening, iron removal, fluoride removal, white water recovery in paper mills, cooling water treatment, process water clarification, tin plate rinse water, oil field flooding water and similar applications.

They can be built in small sizes—such as for the bottling trade, or in very large sizes—such as for paper mills, up to 110′0″ dia., capable of handling more than 20,000,000 GPD in a single unit.

Write for new Solids-Contact Reactor Catalog—Publication 5001-A —just off the press.

COCHRANE CORPORATION WATER ENGINEERS FOR 90 YEARS 1863 - 1953

cochrane

corp. *3108 N. 17th Street, Philadelphia 32, Pa.*

offices in 30 principal cities

In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S.A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris
In Cuba: Laurence E. Daniel, Inc., Havana
In South America: Servicios Electricos, C.A. (S.E.C.A.) Caracas, Venezuela
In Puerto Rico: F. A. Ortiz & Co., San Juan 5

Hot Process Softeners • Deaerators • Dealkalizers • Demineralizers • Reactors • Continuous Blow-Off • Specialties • C-B Systems

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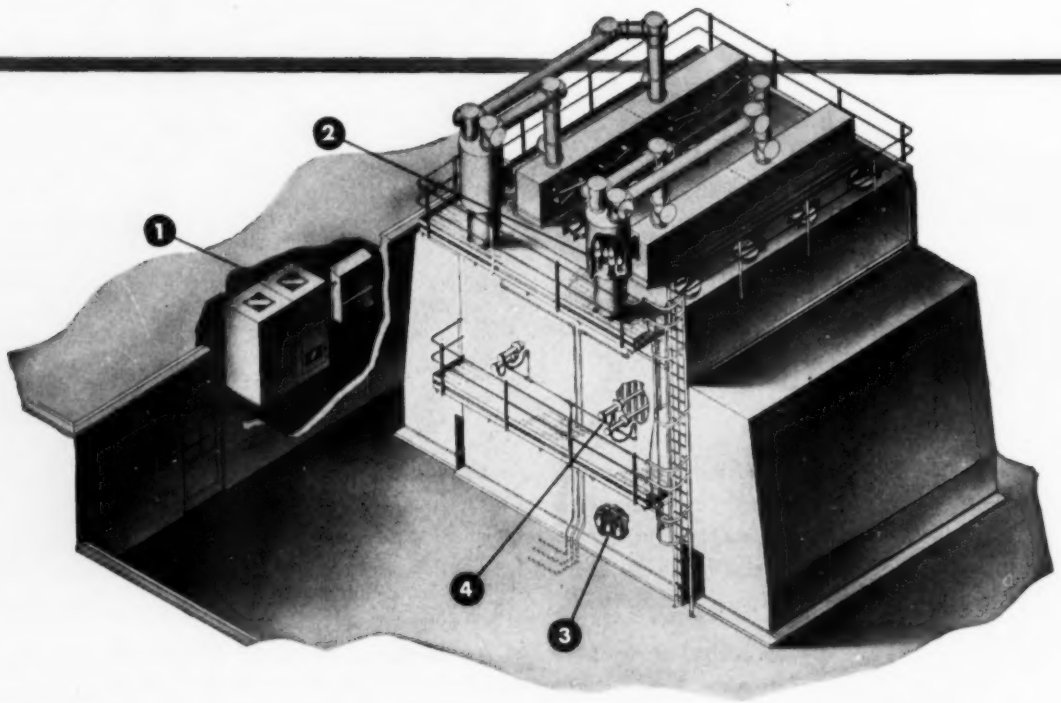
What's New in Electrical Precipitators?



FEATURES:	RESULTS:
1. Remote Control—Entire installation is operated by switchboard control from any convenient location.	**1.** Central control room operator can see all meters and operate all controls that determine optimum performance.
2. Low-cost Energization—Weatherproof high voltage transformer and electronic tube rectification equipment allow location flexibility and minimum power consumption.	**2.** Space conservation, short high voltage connection between rectifiers and precipitators insure compact, economical installation.
3. Unique Electrode Design—Plumb-bob discharge electrodes, individually weighted to remain taut, are uniformly positioned by a lower framework.	**3.** Discharge wires are kept perfectly aligned at all times for maximum overall precipitator performance.
4. Electronically Controlled Rapping—New magnetic impulse rappers are designed for continuous, sequential, smoothly regulated electrode rapping.	**4.** Eliminates stack puffs and produces increased overall efficiency.

Ask your Research Corporation representative to bring you up to date on the details of these and many other improvements that you will find in the modern Cottrell Electrical Precipitator.

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
Bound Brook, N. J. • Grant Building, Pittsburgh 19, Pa.
122 South Michigan Avenue, Chicago 3, Ill.

RC143

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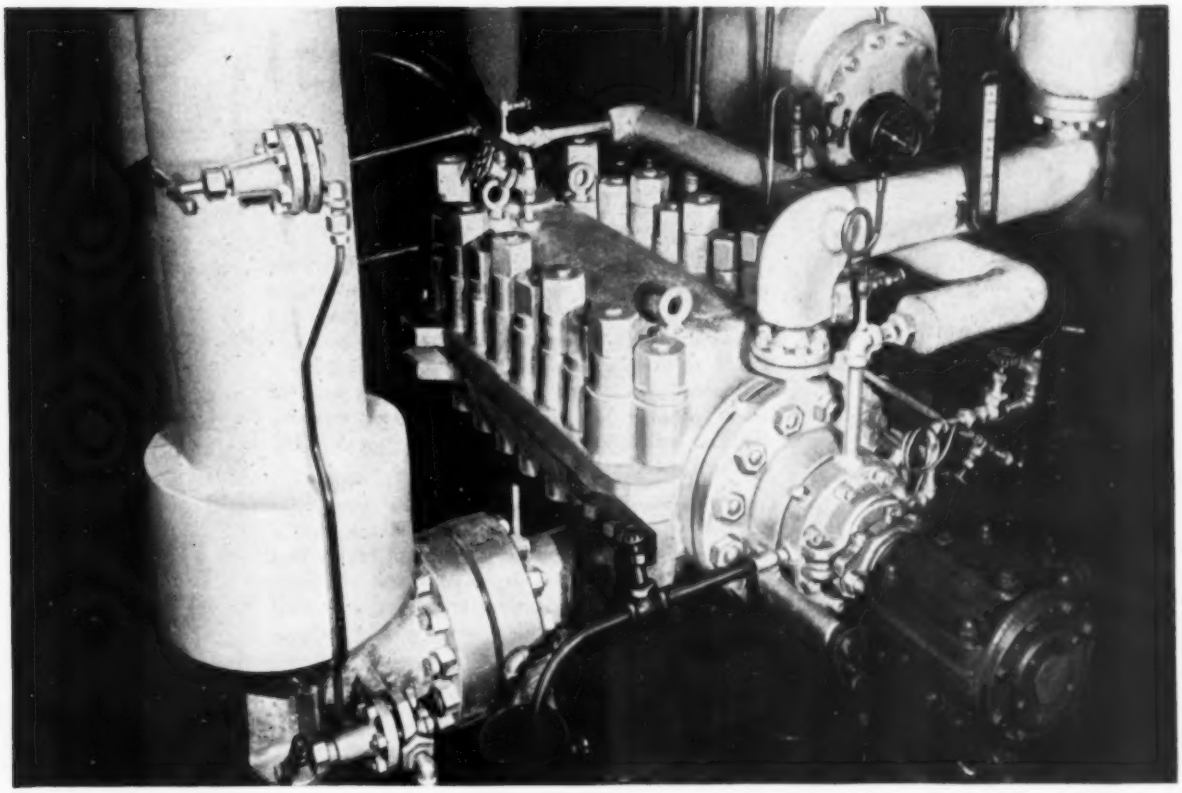
100,000 HOURS

and not opened yet!



This Ingersoll-Rand High Pressure Boiler Feed Pump installed 15 years ago has never been opened for inspection . . . and it still meets capacity and pressure requirements.

The Ingersoll-Rand Class HT pump shown above was installed in 1938 at the Windsor Station, owned jointly by The Ohio Power Company (part of the American Gas & Electric Company) and the West Penn Power Company (in the West Penn Electric Company system). Since that time, it has operated for over 100,000 hours—pumping 1025 gpm of 380° F boiler feed water at 415 psi intake and 1900 psi discharge. Throughout this entire 15 year period, the casing and high pressure breakdown have never been opened for inspection.

There are five other I-R Class HT pumps at this station. Four of these have chalked up unopened service records of from 50,000 to 80,000 hours each.

These outstanding operating records are the result of competent pump operation and feedwater control on the part of the station's personnel—and the careful material selection and high standards of construction inherent in every I-R boiler feed pump.

For *proved dependability* in high pressure service, it pays to specify Ingersoll-Rand pumps.

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"We've Got Facts to Prove Rubilene's Superiority"

A lot of people depend on Mr. W. T. Elliott. For it's his job as Power Plant Supt. to see that the City of Denton, Texas has unfailing light and power 24 hours a day. To help live up to that responsibility, Mr. Elliott pampers his hard working Nordberg Duafuel® engines — makes sure they're lubricated with the finest oil available. He says, "We've been using Sinclair RUBILENE® since 1948 with *very satisfactory results*. Cylinder liner wear is only ⅓ of 0.001 inch per 1,000 hours running. Piston ring life is 16,000 hours of operation and we get 6,100 H.P. hours per gallon of oil... Facts like those have definitely sold me on RUBILENE."

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VALVES, FITTINGS and FLANGES

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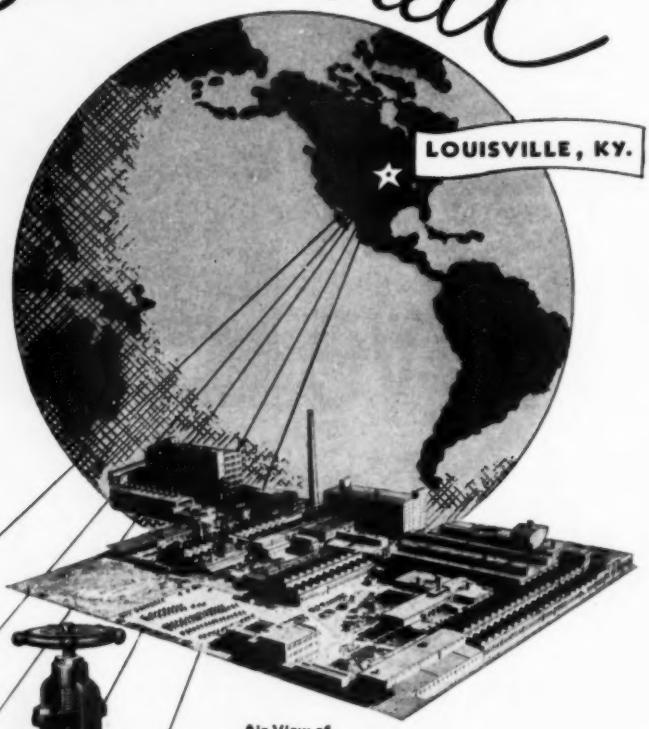

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This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

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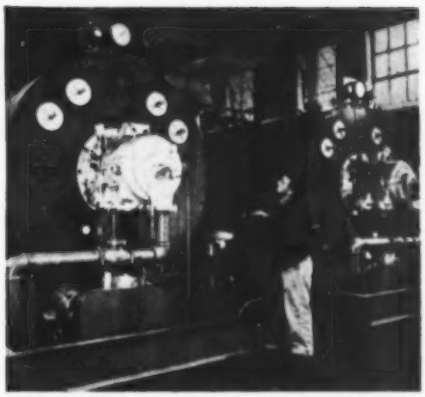
9 REASONS WHY

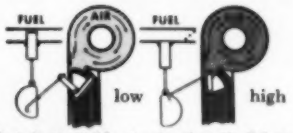
STEAM COSTS GO DOWN



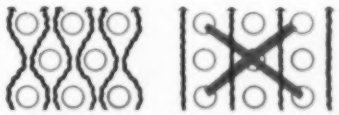
Completely Automatic Operation—Full complement of finest up-to-date operating and safety controls provides maximum operating dependability and protection with least possible attention from operator

.....where *Powermasters* go in ...

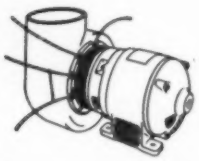
3-Pass Boiler with successive parallel paths and single gas flow reversal at each end assures most efficient flue gas velocity and heat transfer, provides maximum maintenance convenience, and requires no complex front end baffling.



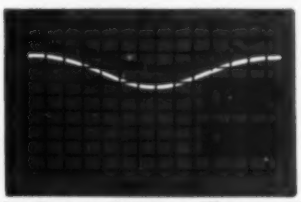
Infinitely Variable Combustion Modulation automatically maintains proper fuel-air ratio for most efficient firing at all loads. Instant response to load swings between 20% to 100% of firing rate saves fuel and assures constant steam pressure and temperature.



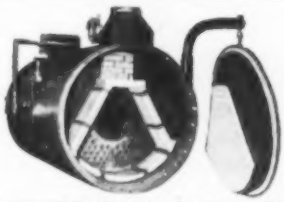
Staggered Tubes—Freedom from ineffectual boiler water eddies assures quicker heating, faster steaming, and high quality dry steam. Scrubbing action of rising water prevents corrosive gas deposits on tube surfaces.



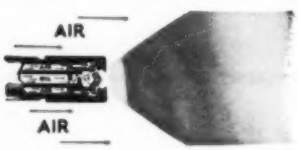
Forced Draft provides most accurate control of combustion air supply; permits use of smaller, low-cost stack, fan and motor; requires less fan maintenance because no hot products of combustion pass through the fan.

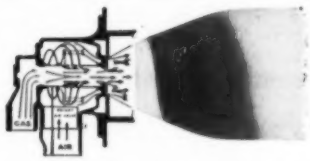


83% Guaranteed Minimum Efficiency with No. 6 oil. At less than full load, *Powermaster efficiency* actually increases! ASME field tests prove *Powermaster's* superior performance.



Easy Accessibility for tube cleaning and inspection is provided by swinging rear cover, and divided front cover that is readily removable without disturbing burner or accessories. Convenient handholes facilitate waterside inspection.





Variflow Burners keep fuel costs low and boiler efficiency high at all loads. Air-atomizing oil burner (left) and pre-mix gas burner (right)—designed by O&S expressly for *Powermaster*—provide complete, clean combustion over full firing range. Simple, sturdy construction with no moving parts, absence of vibration, and ease of cleaning minimize maintenance. Combination burner allows quick change from one fuel to another.

Compare *Powermaster*, feature by feature, with any other package boiler and you'll readily understand why it is so widely used in industrial plants, dairies, hospitals, laundries, schools, public buildings, housing projects, institutions, and many other applications . . . and adding new users at a rapid rate.

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Describes and illustrates all cost-saving features of the modern, completely assembled, and factory fire-tested *Powermaster*. Ask for Bulletin 1219 on your company letterhead, stating your steam requirements and operating conditions.

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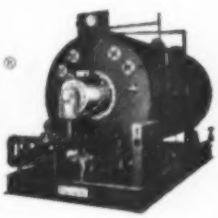
PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.



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How you gain by specifying R/M's BIG 7 packing types

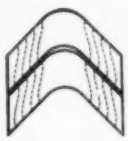
You lower inventories! Simplify your ordering! Reduce your downtime! No longer must you have 10, 20, 30 different types of packings to satisfy your plant's requirements. Unless you have extremely rare packing applications, just three or four of R/M's new basic line of seven field-tested packings will meet all your needs. To find out how, call in your distributor.

Here's the story on TYPE 7

Type 7 is R/M Vee-Flex®. The success of Vee-Flex is its special design by which pressure from the medium being packed transmits itself through the packing to produce positive sealing against the stuffing box wall and rod. This is accomplished by R/M's unique convexly curved surface on the pressure side of the packing. Photoelastic analyses,* corroborated by radial pressure tests,* prove that maximum sealing performance occurs at a point slightly below mid-width on the sealing area.

**Performed at the Franklin Institute Laboratories for Research and Development*

Simplified diagram of stress trajectories in R/M Vee-Flex Rings with convexly curved surfaces.



Simplified diagram of stress trajectories in ordinary V-type rings with flat contact surfaces.

R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Teflon Products • Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

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DIAMOND Boiler Cleaning Systems again selected by American Gas & Electric

for

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The Ohio Power Company

KANAWHA RIVER PLANT
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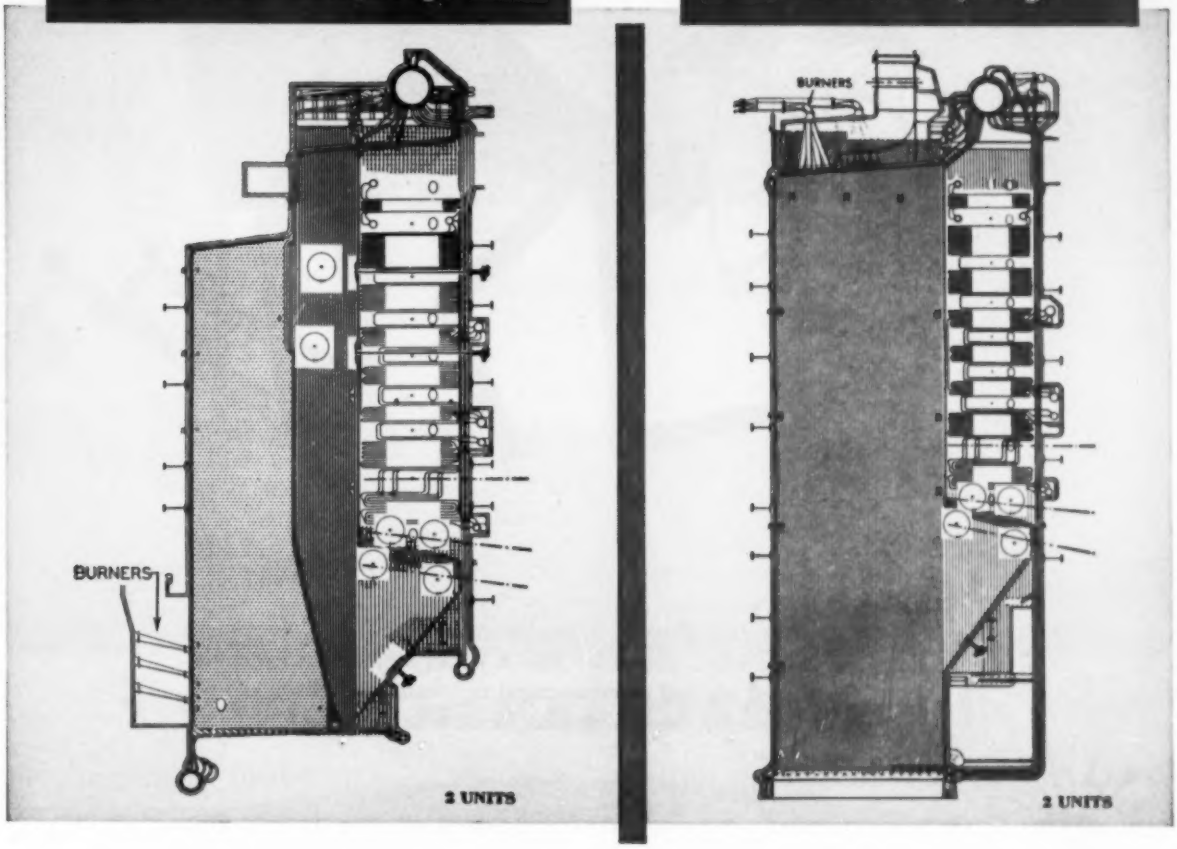

Similar, yet different, these units are built in the tradition of American Gas & Electric philosophy: "for tomorrow." Incorporating high pressure . . . high temperature . . . reheat . . . pressure firing . . . flue gas recirculation, they will provide economical power to serve the growing capacity needs in two different areas.

Both plants will have Diamond retractable type blowers (throughout) to assure safe, economical and reliable operation. These units are constructed along principles successfully established at Twin Branch, Tanners Creek and Philip Sporn Plants which are all Diamond equipped *throughout*.

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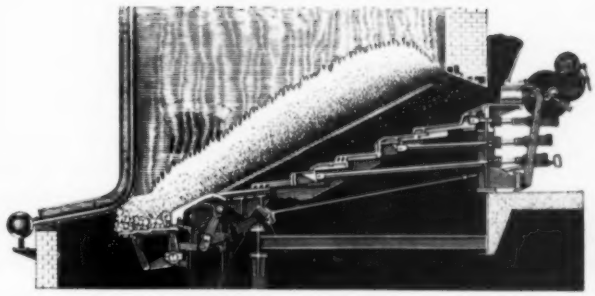

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FIVE DIFFERENT HEADACHES have often been inseparably connected with stoker operation... and every one of them is eliminated by the modern, engineered AE Taylor Stoker.

CO_2? That's where Taylors give you unrivaled efficiency. *Quick load response?... complete dependability?* Taylor Stokers are completely tops in both respects. *Stack discharge nuisance?* Taylors meet the toughest municipal ordinances. With proper grate area, over 98% of the ash goes to the pit. *Burning versatility?* Properly proportioned, Taylors can and do burn coals satisfactorily from all over the U.S., and from Canada, England and the Continent as well.

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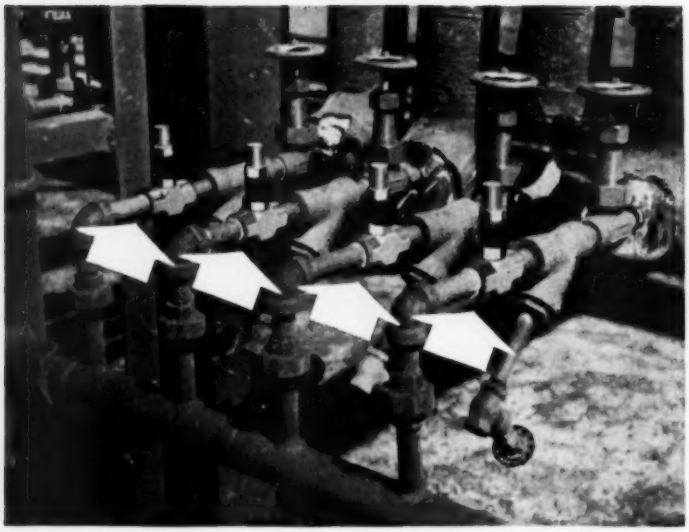
3000 impulses help keep mid-west refinery "on stream"



THIS big refinery at Lawrenceville, Ill.—like a lot of other important refineries — uses Yarway Impulse Steam Traps.

Over 3000 Yarway Impulse Traps are installed on tracer lines and for draining steam headers.

Popular features of the Yarway Impulse Steam Trap are its ability to get equipment *hot in a hurry*—and keep it hot! . . . also its small, handy size—fits in easily in any location; its stainless steel body and working parts; quick installation; easy maintenance; low initial cost.

Another advantage — IMMEDIATE DELIVERY from 250 local distributors, plus quick service from nearby Yarway field engineers.

More than 900,000 Yarway Impulse Steam Traps have been sold. For a free Steam Trap Selector, write . . .

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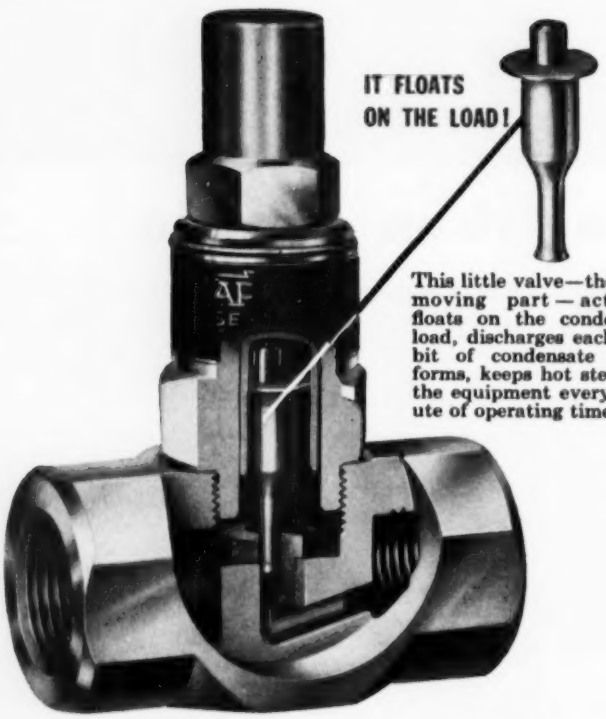

This little valve—the only moving part — actually floats on the condensate load, discharges each tiny bit of condensate as it forms, keeps hot steam in the equipment every minute of operating time.

YARWAY impulse® steam trap

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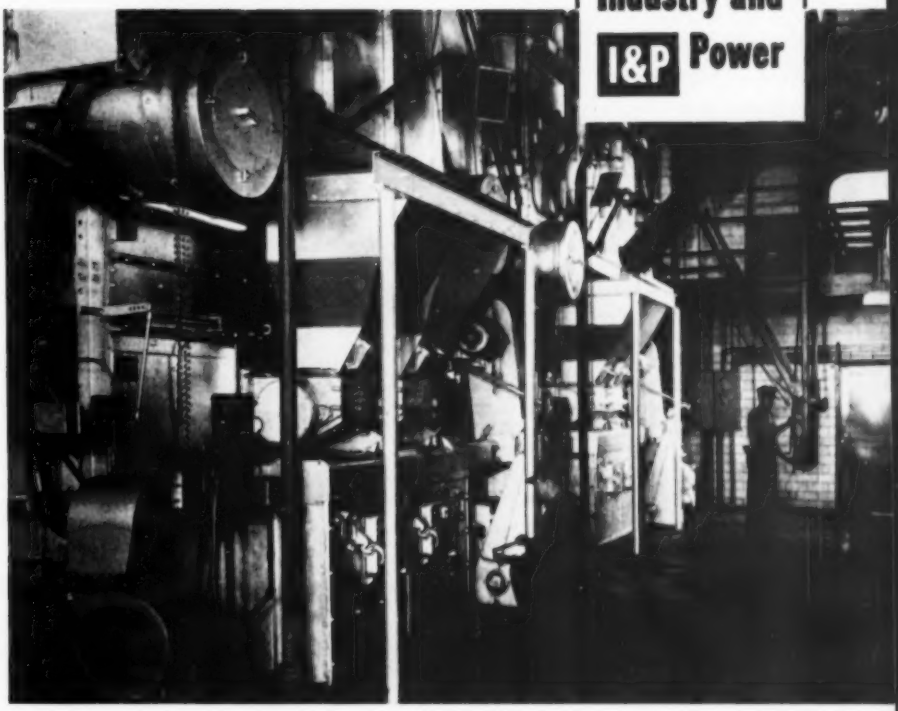


Model small steam generating plant at right has modern "A" type boilers, spreader stokers, and a fully integrated system of instruments and automatic combustion control equipment.

WILLIAM H. PUGSLEY
Vice President
Field Research
The Hays Corporation

Instrumentation and Combustion Control For Small Steam Plants

MANY SMALL steam generating plants in the range of approximately 3000 to 20,000 lb of steam per hr output are serving industry. These plants, consuming between 1000 and 8000 tons of coal per year, are far more numerous than their larger counterparts. Yet, when they are designed, their instruments and automatic combustion controls usually receive less consideration (in comparison with the larger plants) than the boiler, fuel burning equipment, pumps, and other facilities.

There are several reasons for this situation. First, the small plant can produce steam without instruments and automatic controls while larger, more complex installations must have instrumentation and some automatic or at least remote manual control. Second, there is no question of the economic value of a comprehensive installation of instruments, safety controls, signal devices, and automatic combustion controls for the larger units. On the smaller units, however, the margin of return on the investment is smaller and usually discounted considerably. Third, the installation of a small steam generating plant is many times only one small part of a large expansion to a manufacturing plant or institution. As a result, instruments and automatic combustion controls become a more or less unimportant part of the steam generator and do not receive proper attention.

Instruments and automatic controls are two distinct types of equipment, each of which is designed for a specific purpose. The instruments serve as guides for the boiler plant personnel and also provide management with information for calculating operating costs. Automatic controls actually perform the function of regulating the equipment to maintain uniformly high efficiency. Since these services are related, most satisfactory results are obtained by using completely integrated facilities. Selection of the type of control system and the arrangement of individual instruments, however, will depend upon the specific requirements of the project.

Draft Gages

Since most small steam generators are simple in design, usually a three point draft gage is ample. An indication of the furnace draft is the most important and next is the primary combustion air pressure, commonly called the forced draft. When multiple zone stokers are used, the air pressure under each zone should be indicated. Last in importance is the draft ahead of the boiler outlet damper or after the gases have pass-

ed the last heating surface of the boiler. From these indications, the operator can properly control both the combustion air volume and the distribution of air to the fuel.

Steam Flow Meters

Steam flow meters have been called the cash register of the boiler room. Very few men in any plant are given much money to spend just as they see fit. The fireman, however, is given fuel to spend at his own discretion. Steam meters tell how efficiently he is spending that fuel.

Various meters are available which indicate, record, integrate, or show the flow by any multiple combination of these methods. Recording meters are particularly valuable because the chart provides a permanent record of load changes as they occur throughout a 24-hr period. Furthermore, by observing the chart the operator is informed of the trend in the load and can prepare to handle it most economically by cutting boilers into or out of service or by adjusting the fuel bed for the new load condition. Unusual and unnecessary use of steam often can be detected and the cause determined and corrected.

Integrators facilitate cost determinations by totalizing the amount of steam produced during any selected period of time. From these data and the amount of fuel burned, the efficiency with which the steam was generated (generally expressed as a relationship of pounds of water evaporated per unit of fuel burned) can be established. In most plants, this information then is converted to fuel cost per 1000 lb of steam.

It is good engineering practice to provide a steam flow meter for each steam generator, especially when more than one unit is in operation at the same time. Then operating efficiency and output can be determined for each unit. Depending upon the physical arrangement of the piping, the load, and other operating conditions, it may be possible, although not more desirable, to use one flow meter in the main steam header instead of one for each boiler.

Feedwater Meters

In general, feedwater flow meters have given way to steam flow meters where a choice has to be made between them. The steam flow meter provides a better indication since it actually follows the rate of steam generation. Feedwater flow may be influenced by other factors, such as water level in the boiler, and therefore it does not always indicate the actual load condition. However, positive displacement type hot water meters have been used with small size steam generating units where it was believed that the cost of a recording or integrating type flow meter was not justified. These applications are limited because hot water has practically no lubricating qualities, and this type of meter requires frequent attention.

Control panels simplify operating procedures and provide performance data.

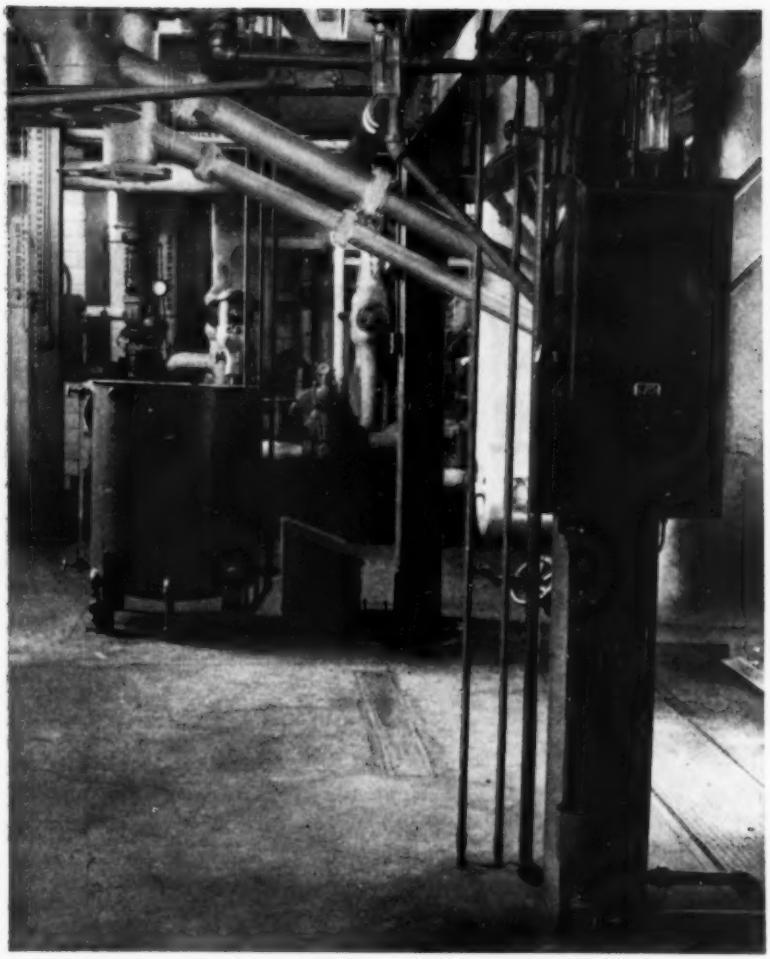
Combustion Guides

Two principal types of instruments, qualitative and quantitative, are used as combustion guides. The qualitative type or gas analyzer measures the percentages of the various stack gas components rather than quantities. Orsats, CO_2 recorders, and O_2 recorders fall in this classification. The quantitative type includes air flow-steam flow and gas flow-air flow meters, which actually measure the total flows on a quantitative basis.

Of all combustion guides, the Orsat is the best known, although it is not intended for daily operating usage. It is primarily a test instrument, used for running boiler or combustion tests, checking the calibration of automatic CO_2 recorders, and establishing the air flow-steam flow relationship on boiler efficiency meters. Orsats also are used to calibrate automatic combustion control systems when the plant instrumentation does not include a recording combustion guide.

CO_2 Recorders

In many small plants, automatic CO_2 recorders are used as a direct guide by the fireman for adjusting the fuel-air ratio. Its readings and the flue gas temperature also provide data for readily determining heat losses. While good engineering dictates the use of a separate CO_2 instrument with each boiler, it is possible to connect one meter to several steam generators but preferably not more than three. When such



Gas analyzers qualitatively measure the percentages of stack gas components.

an arrangement is used, the instrument can serve only one unit at a time, and must be switched from one boiler to another depending on operating conditions. This requires valves in the gas sampling lines.

Quantitative guides to combustion efficiency must be applied on a unit basis. This is necessary because the air flow record must be individually calibrated with reference to the steam generator with which it is used. As a result, boiler efficiency meters cannot be applied when only one steam flow meter is measuring the output of several boilers. Since the air flow recorder is a measurement of the draft loss through the boiler, it follows that it is not usable with boilers having extremely low draft loss such as an HRT boiler.

Other Instruments

Indicating and preferably recording instruments should be provided for steam pressure in the main header, temperature and pressure of the feedwater, and temperature of the flue gases at the outlet of each steam generator. These records not only serve as a check on the operation of the equipment but also assist in calculating efficiency and output.

Records of these functions generally can be incorporated on the charts of the steam flow and CO_2 meters, or several such records can be combined in one instrument. This reduces the cost and also coordinates the several records of related functions. For example, steam pressure and flow are related and should be combined on the steam flow meter chart. Flue gas temperature and CO_2 likewise are related and can be combined in the same instrument.

Automatic Combustion Control

Automatic combustion control is purchased for what it will do and do better than can be done in any other way. Primarily, its purpose is to increase combustion efficiency and thereby save fuel dollars. In accomplishing this objective, the controls maintain constant steam pressure which often reduces the over-all cost of manufacturing operations that depend upon process steam. In addition, the minimizing of smoke and air pollution improves community relations.

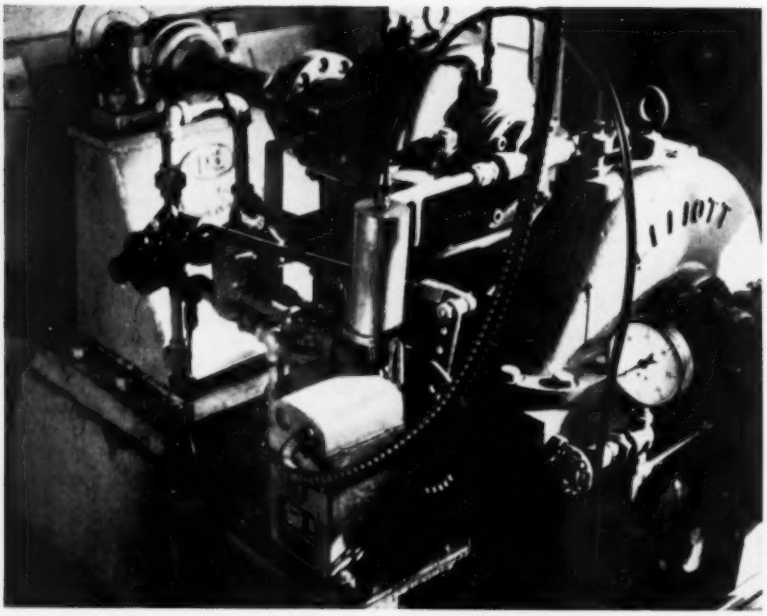
Labor saving is next to fuel saving as one of the benefits of automatic combustion control. In most plants management does not expect to completely replace operating personnel but rather to relieve the firemen from the tedious task of manually adjusting the equipment. Automatic combustion control allows operators to use their time to the far greater benefit of observing and correcting over-all operating conditions. It must be remembered that no matter how high an efficiency a steam generating unit may produce on test, what really counts is how close these tests efficiencies are approached in daily operation.

Safety Features

Safety is another factor in the operation of a steam generator which is improved through automatic control. Keeping the steam pressure within close limits and holding the furnace draft at a constant value (preventing a positive pressure in the furnace) are two of the obvious benefits. Other possible safety features include flame-out controls when firing oil and gaseous fuel, and load limiting controls to keep the rate of steam generation within the capacity of fans or to prevent the feed of fuel without the air to burn it. Furthermore, operation near the maximum capacity of the boiler is safer with automatic than with manual control. At times, this may eliminate the necessity of putting additional units into operation to meet short peak load conditions, which in effect increases the steaming capacity of individual units.

Types of Control Systems

Automatic combustion control systems fall in two classifications, positioning and metering. Both systems operate on the same general basis, responding to changes in steam pressure as being representative of changes in demand for heat input to the boiler. They both control the rates of fuel feed and air flow in an effort to maintain steam pressure within close limits and combustion efficiency at a uniformly high level. Each system utilizes furnace draft controllers, one for each boiler, to hold the furnace draft constant at a predetermined low negative value,



All systems maintain constant furnace draft by damper or fan speed control.

generally by operating the boiler outlet damper. The two systems differ primarily in the method used to control the rates of fuel feed and air flow for combustion.

Positioning Systems

One positioning system consists of a single master steam pressure controller which adjusts fuel feed and air flow rates by positioning the levers on the firing equipment and forced draft dampers. This unit generally is used to control all of the steam generators connected to the header in which the pressure is being controlled.

The system requires mechanical linkages to the air and fuel controls on all the steam generating units which produces a cumbersome arrangement. It is expensive to install and maintain, has too much lost motion, and provides no flexibility of operation in the way of means for changing fuel-air ratio or the loading of boilers. Too great a percentage of the total cost is in the installation which does not enhance the quality of the controlled results.

It may seem desirable to equip each separate steam generator with a master controller, thereby eliminating shafting and linkage or other means of transmitting the master loading impulse to all boilers. Such an arrangement is satisfactory except when more than one boiler unit is in operation at the same time, in which case the result is to swap the load between boilers. One or more of the boilers pick up most of the load while the rest of them drop it, and then the reverse cycle takes place. The use of one master steam pressure controller eliminates this undesirable condition.

A positioning system which is much preferred is one in which mechanical connections are required only between each individual power unit and the lever it operates. This arrangement, sometimes referred to as a remote positioning control system, is shown in Fig. 1. The master loading impulse is transmitted electrically, pneumatically, or hydraulically to the individual power units quickly, accurately, and without lost motion. With this system manual control and adjustments can be provided at a centrally located panel or on individual panels at each boiler.

Manual control stations greatly increase the flexibility of operation. Steam generators may be taken off automatic control and placed on base load or fixed output, the ratio of fuel to air may be changed at will, and any one or all functions of the steam generating unit may be automatically or manually controlled from the panel as desired by the operator. These are very important features since a positioning system does not always make exactly the required change in the air and fuel supply for each change in load. Therefore, manual adjustments must be made to compensate for errors.

Sources of Error

Errors are caused by two factors. First, the character of the relation between the rate of fuel feed and the position of the lever controlling it is not a straight line. Also the character of the relation between the rate of air flow and the position of the forced draft air damper is not a straight line. In addition, both relations are never exactly alike. Thus, it is practically impossible to accurately calibrate the simultaneous movements of the fuel and air control levers to produce the desired air-fuel ratio over the entire range of operation.

The second factor that is a source of error in the positioning type control is the variable conditions that affect the results which would otherwise be secured by mechanical calibration of the linkage system. For example, any one position of the fuel feed control lever may not always cause the corresponding rate

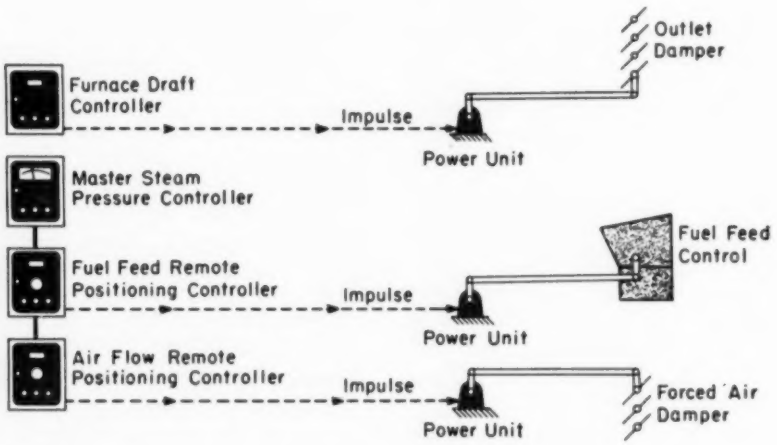


Fig. 1—Typical arrangement of a remote positioning combustion control system.

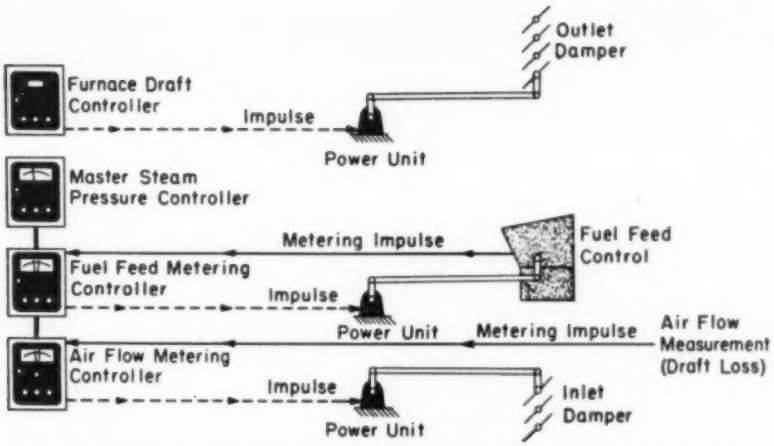


Fig. 2—Typical arrangement of a metering automatic combustion control system.

of fuel to be fed into the furnace. It will be changed by variations in valves, pumps, motors, turbines, engines, viscosity of fuel oil, pressure of gas, steam pressure, load on the stoker drive, slippage of drive belts, lost motion in the feeding mechanism, or other irregularities.

Any one position of the forced draft air damper may not always produce a corresponding rate of air flow into the furnace due to the variations in fuel bed resistance, atmospheric conditions, boiler settings, fans, motor or turbine drives, zone damper positions, and lost motion in damper linkage. When one fan supplies air to more than one boiler, the number of boilers, their load, and their location in relation to the fan affect the air volume to each boiler. It is not feasible to control fan speed for air volume with a positioning system of control because of the large number of variables involved.

In spite of all these possible sources of error the positioning system of control will do a good job of controlling steam pressure and furnace draft. In fact, with good mechanical calibration of the system the variables listed sometimes cancel each other out, and fairly good control of fuel-air ratio can be obtained with an occasional manual adjustment. It must be remembered, however, that positioning systems will control for high, fair, or poor efficiency depending upon how they are adjusted and maintained.

Metering Systems

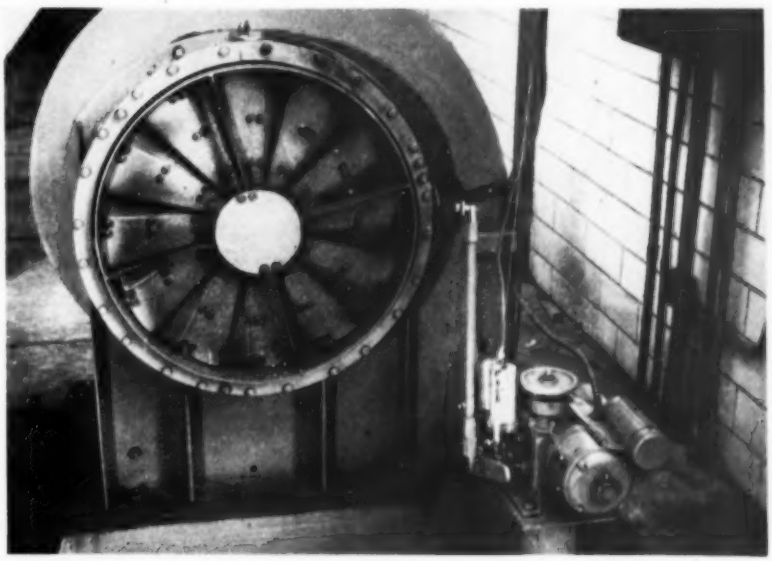
The best answer to automatic control problems is the use of a system which compensates for most of the variables and can be easily and accurately calibrated to maintain a high percentage of efficiency with minimum manual adjustment. This is the metering system of control as shown in Fig. 2. As its name implies, the metering system is based on the principle of measurement. While this type of automatic control has not as yet been used extensively in small plants, it is now being used almost exclusively in plants only slightly larger than the stated sizes.

Metering systems differ from positioning systems in that separate air flow and fuel feed controllers are provided for each boiler which control the fuel-air ratio on a measured basis. Metering controls provide all of the flexibility of remote positioning controls without requiring calibration of the mechanical linkage. In addition, they compensate for practically all of the variables which affect positioning controls.

The air and fuel controllers are calibrated to reproduce values of draft loss or air flow, rate of stoker speed or fuel feed, and fuel-air ratio which have been found by actual operating tests to produce the desired combustion efficiency. These predetermined values may be established from CO_2 content in the flue gas or from the steam flow-air flow relationship. Since the controllers measure the rate of air flow and fuel feed, it follows that the characteristic of the device controlling the fuel feed or damper levers is of little concern. The automatic controllers move the levers to whatever position is required to produce the desired result.

Conclusions

Engineers should look well into the future when building new power plants. If proper consideration is given not only to the design efficiency of the steam generator but also to what the daily operating costs and working conditions will be, the importance of instruments and automatic combustion controls will be apparent. Fuel and labor costs are higher now than at any time in the past. More plants are finding it necessary to utilize equipment which is designed for a wider variety of lower quality fuels. Since instruments and controls alleviate these problems and provide very satisfactory investment returns, it is predicted they will be used more in small steam plants in the future.



Primary air flow can be controlled by positioning inlet vanes on the FD fan.

Gas-fired annealer (left) and neighboring electric annealer (right) typify side-by-side applications of differing fuels.

Fuel Selection for Heat Treating at Caterpillar

GLEN C. RIEGEL and **THOMAS SPENCER**
Chief Metallurgist **Ass't Metallurgist**
Caterpillar Tractor Co. **Caterpillar Tractor Co.**

CATERPILLAR TRACTOR CO. heat treats almost 50 percent of the metal tonnage that goes into its final products. There are many good reasons why Caterpillar uses both gas and electricity as heat sources. Cost is one of these.

It is generally acknowledged that in the Peoria area, natural gas is the cheapest source of heat on the basis of cost per Btu; propane may cost three to four times as much. On a potential heat basis, electricity would be eight times more costly than natural gas. Because utilization efficiencies of electricity are very much higher than that of gases, however, electricity proves to be only about three times as costly in the ultimate heat-treated product, human factors considered.

Most often, cost is an initial factor which later becomes secondary to other factors. In one class of operations, gas is not only a heat source but is also a reagent. Gas used in carburizing, for example, is a chemical agent in the process and as such has no substitute. Considering reaction gases, the element of choice does exist between natural gas and one of the liquefied petroleum gases such as propane.

The former popularity of butane is diminishing even though butane has some advantages in heat content; however, butane tends to liquefy in piping at normal operating temperatures, causing fire and perhaps explosion hazards.

Favoring natural gas is cost. In

addition, reaction gases must be of uniform and known composition if quality uniformity is to be maintained in the end products as in carburizing. Here, natural gas excells again. Deviations in the composition of natural gas are smaller than in propane. Taking heat content as an example, natural gas is supplied to Caterpillar with an expected variance of ± 1 percent; the variance in propane is ± 2.78 percent. Finally, natural gas is less sooty than propane, and this is advantageous.

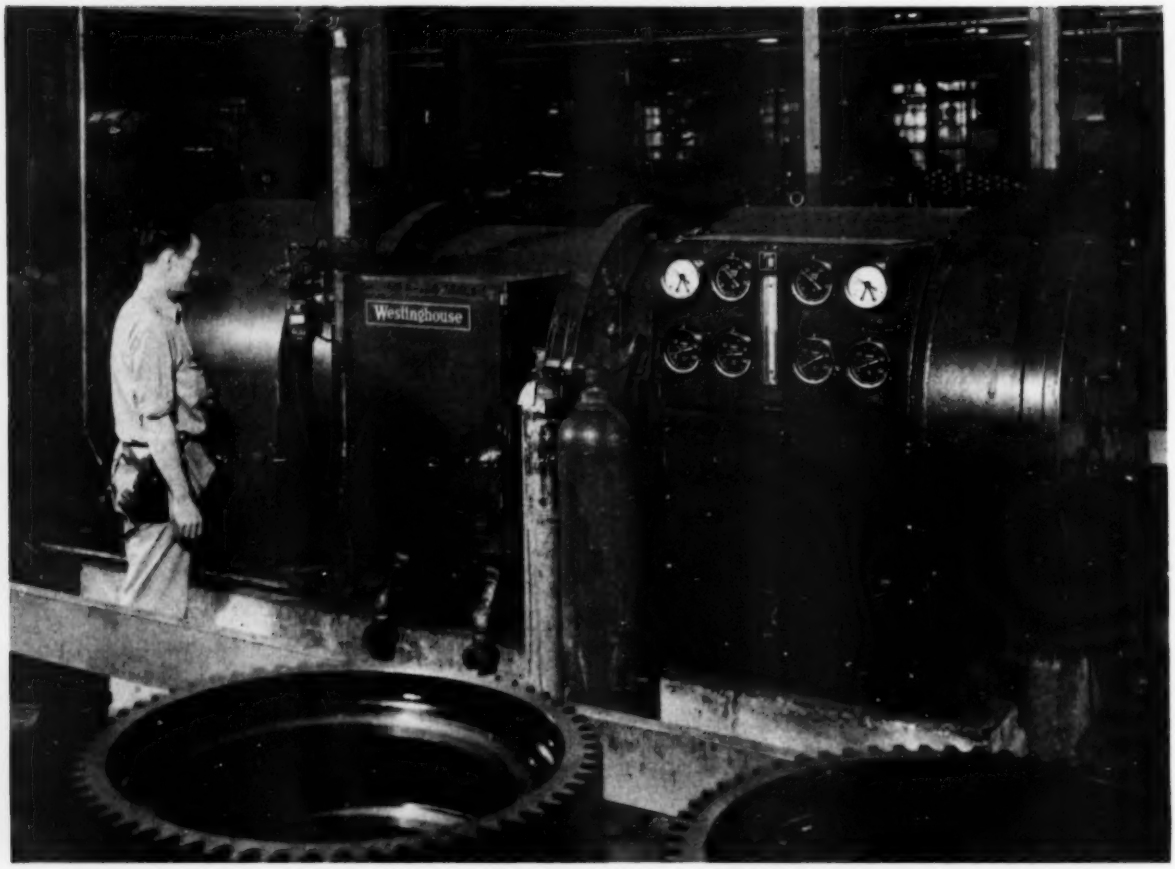
Scheduled Changeover

The stumbling block preventing exclusive use of natural gas as a heating or reaction gas is its limited availability. In recent years, increasing numbers of home heating plants have been installed using natural gas. This has placed Caterpillar and other industrial users in an "interruptible" status. They must be prepared to stop using natural gas whenever home demands increase beyond the gas supplier's ability to provide for both home and industrial loads.

When it became apparent that

Electric induction hardener heats tooth ring on gear and quenches it; the operating cycle is automatic.

Eighteen 30,000-gallon tanks hold enough propane to supply average demand—2½ million cu ft per day—for 13 days.



This 500 kw hydrogen-cooled generator supplies power for induction hardening operations. Much of Caterpillar's heat treating equipment is conceived and designed by Caterpillar engineers; equipment is then purchased to specifications.

whims of the weather might enforce a change at any time from natural gas to "standby" propane, Caterpillar developed a scheduled spring and fall changeover program. The obvious advantage lies in the freedom of choice to plan such a changeover during non-production hours.

Caterpillar engineers need one-half hour to change reaction gas in the furnaces and the supply lines from natural gas to propane vapor. This interval adequately protects personnel and equipment from the hazards characteristic of these explosive furnace atmospheres.

Only two changeovers per year are made instead of the many which might be necessary if weather were the sole factor determining when natural gas could be used. Changeover is removed from the category of emergency operations, and costly furnace charges are not jeopardized by last-minute orders to change gases.

Perhaps the major economic advantage in the planned changeover is that the use of natural gas and propane can be correlated with Caterpillar's over-all program of scheduling the consumption of fuel to take advantage of the most favorable rates throughout the year.

Burner Gas

Gas used solely as a source of heat presents fewer problems in changeover. The piece parts in annealing furnaces, for example, are insensitive to the kind of furnace fuel. Equipment using gas for heating is the least sensitive to changeovers from one gas to another. The primary requirement is to maintain optimum burner efficiency regardless of the gas used.

Burners at Caterpillar are designed to use natural gas containing 1022 Btu per cubic foot. Taking account of specific gravity and its effect on burner operation, Caterpillar uses a propane vapor and air mixture having 1350 Btu per cubic foot as the standby fuel in lieu of natural gas. Caterpillar can start up its propane plant and convert its burner service from natural gas to propane-air vapor in ten minutes.

When propane is called upon as 100 percent replacement, Caterpillar burns 1,900,000 cubic feet of propane-air vapor in place of the normal 2,500,000 cubic feet per day of natural gas.

Tank Farm

The propane supply is kept in an 18-vessel tank farm. Each tank has a liquid capacity of 30,000 gallons; in summer, each is loaded with 23,000 gallons of propane, and in winter the loading may go as high as 25,000 gallons of propane in each of the storage tanks.

The capacity of the propane tank farm would permit full-scale operation for 13 days without replenishment of the propane tanks. This capacity is considered adequate for the most severe and extended curtailments of natural gas which may be expected.

When the character of an opera-

tion permits a choice of energy source, operators and supervisors generally prefer electric furnaces to gas-fired furnaces.

Operators are generally more comfortable around electric furnaces; they can move around an electric furnace freely. The ambient temperatures around electric furnaces are comfortable whereas temperatures between neighboring gas furnaces are oppressively high, often as high as 135 F.

Accidental burns around gas furnaces are common because of the very hot ducting and other attachments. Electric furnaces have comparatively few projections and the outside walls can be touched without burning.

Perhaps the most disturbing worker factor is the fear of combustion noises, "pop-backs," fires, and explosions around gas furnaces. The safeguards against electrical furnace hazards are generally of a level which inspire greater worker security. Even with automatic ignition and flame monitors, operator experiences with hot gas furnaces do not generate the same degree of confidence as do electric furnaces.

Precision Control

Though fuel costs favor the use of gas, electric furnaces lend themselves more readily to precision control of heat treating temperatures. Because this is true, electric furnaces are justified chiefly where precision control is mandatory.

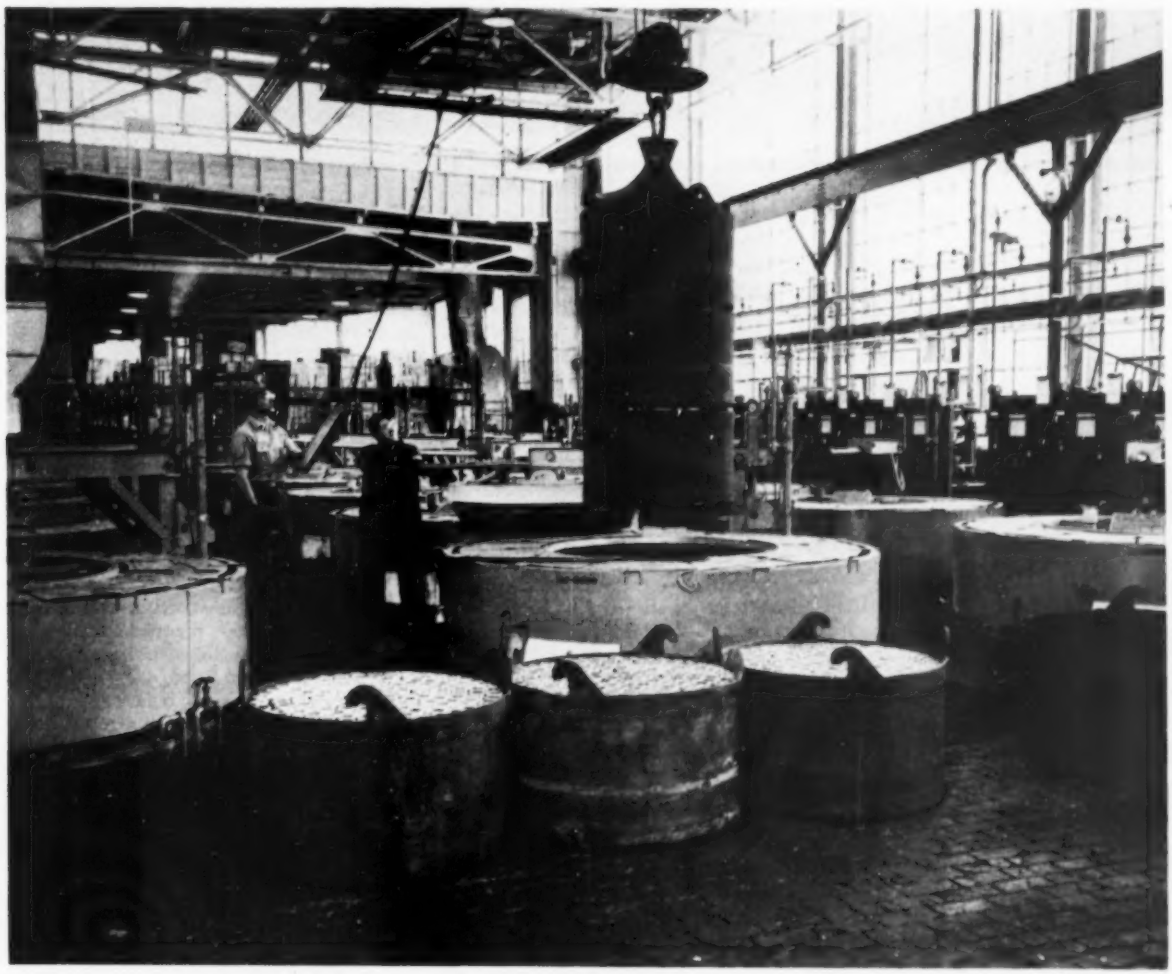
Where precision control and precision work exist, the pay scales of workers must be correspondingly higher. More often, the lighter precision jobs are routed through electric furnaces.

The spent gases which are carried away from gas furnaces represent a heat loss which has no counterpart in the electric furnace. The cost of recovering the heat in these gases is too high to justify recovery; nonetheless, the loss exists.

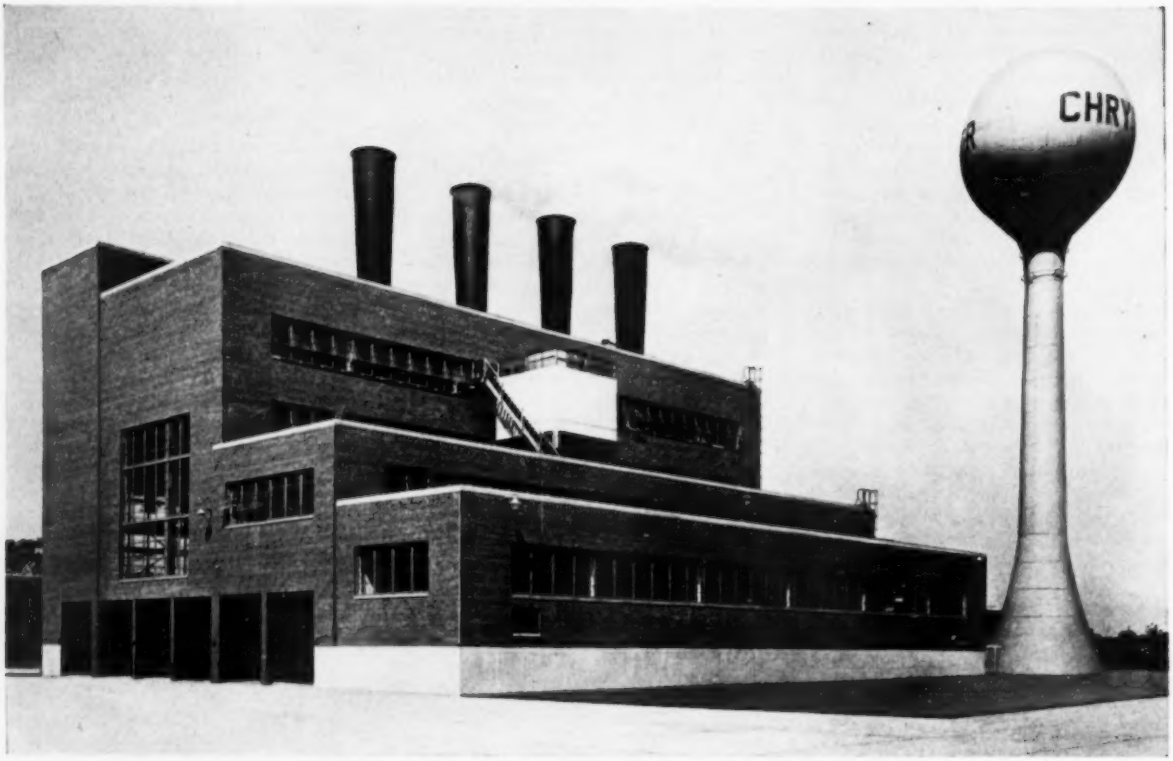
Trend to Electric

Caterpillar still finds that there is a place for each type of furnace. The only hint that a definite trend may develop stems from the fact that electric induction hardening processes permit highly localized treatments on individual parts. This in turn permits use of less expensive metals which can be selectively treated in areas where needed to get characteristics of more expensive metals and alloys.

This indicates a trend toward more electrics, though the need for reaction gases will continue. Though the limited availability of natural gas demands reserves of liquefied petroleum gas, the price advantage of natural gas remains attractive.

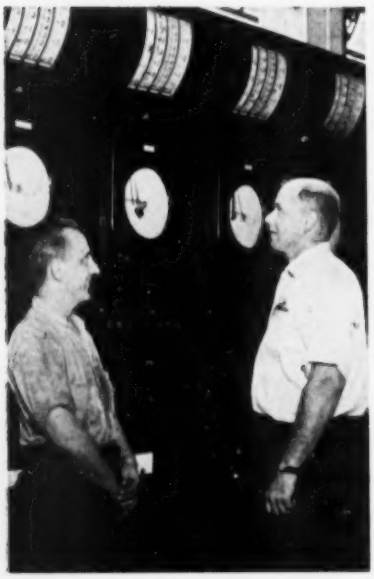


Pit type radiant tube carburizing furnace is used to carburize bushings. Bushings are stacked on end, three high in each pot. Pit extends 14 ft below floor level. Reaction gases can be seen burning off from pipes above furnaces.



Step-down bays, left to right, contain the coal conveying system, steam generating equipment, air compressors, and switchgear.

Chrysler Centralizes Plant Utilities



Chief Engineer H. L. Stone, right, and J. F. Zielinski at the control panel.

CHRYSLER'S Trenton Engine plant exemplifies several modern trends in industrial plant design. Production equipment for machine tool, assembly line operation is in a single, one story building. Engineered plant facilities are consolidated in two separate buildings adjacent to the manufacturing area and connected with it through an underground tunnel, which contains all essential service lines. The entire plant is brick construction on structural steel framing. It provides clean, efficient working conditions and requires minimum maintenance.

Utility Services

The consolidated service center, consisting of the boiler plant and the waste disposal building, furnishes all plant utilities. Its functions include: (a) process and heating steam generation, (b) primary electrical distribution, (c) compressed air production, (d) water supply, (e) fire protection, and (f) waste disposal. Since all facilities are closely correlated, the arrangement permits centralized supervision and assures continuous availability of those services which are essential for production.

Electrical Distribution

This plant is faced with the high power and low process steam loads typical of machine tool production. Since this condition does not afford a favorable heat balance for by-product generation, all electric power is purchased from the Detroit Edison Co. Three feeders enter the plant through substations and pass to the primary switchgear room in the boiler house. From this point, power is distributed at 4160 volts to three load centers in the plant and to the house transformer serving the boiler plant auxiliaries.

Steam Generation

Summer process steam loads for washing and degreasing average

Four, spreader stoker fired, two drum, bent tube steam generators supply the plant's process and heating steam requirements.

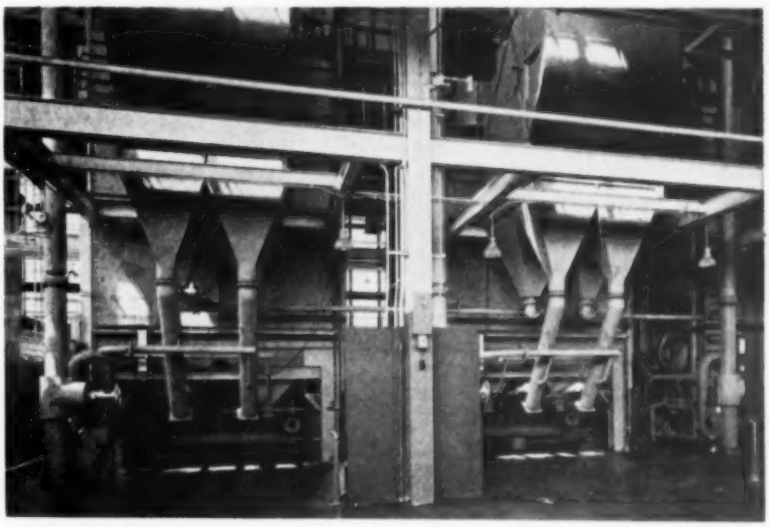
about 10,000 lb per hr. During the winter, heating demands increase the average load to 40,000 lb per hr, with a peak of about 65,000 lb per hr. These requirements are satisfied by four, bent tube, two drum steam generators with fully water cooled furnaces. Each unit has a rated output of 50,000 lb of saturated steam per hr, which means the plant has ample reserve capacity for anticipated future load increases. Design pressure is 200 psig, and normal operation is at 150 psig.

All boilers are designed for spreader stoker firing of Ohio bituminous coal. Fuel ranges from a 10,000 Btu per lb strip mine coal to a 13,000 Btu per lb coal of deep mine quality. At present, the plant engineer finds it economically advantageous to burn the higher quality fuel. This coal costs $7.82 per ton including handling charges. Satisfactory performance is obtainable, however, with all available coals.

Coal Handling

Coal is delivered in railroad cars and emptied into a gravity track hopper with the aid of a car shaker. From there it is carried by inclined, vertical, and horizontal conveyors to an overhead bunker which runs the full length of the boiler house. This bunker is of steel construction with a sprayed gunite lining, and it serves as the live storage area. In addition, an outdoor storage pile averaging approximately 7000 tons provides adequate fuel reserve. When reclaiming from this pile, the coal is crane loaded into cars and handled in the same manner as deliveries which go directly to the bunker.

In the boiler room, a traveling weigh larry draws coal from bin gates, which are spaced at intervals

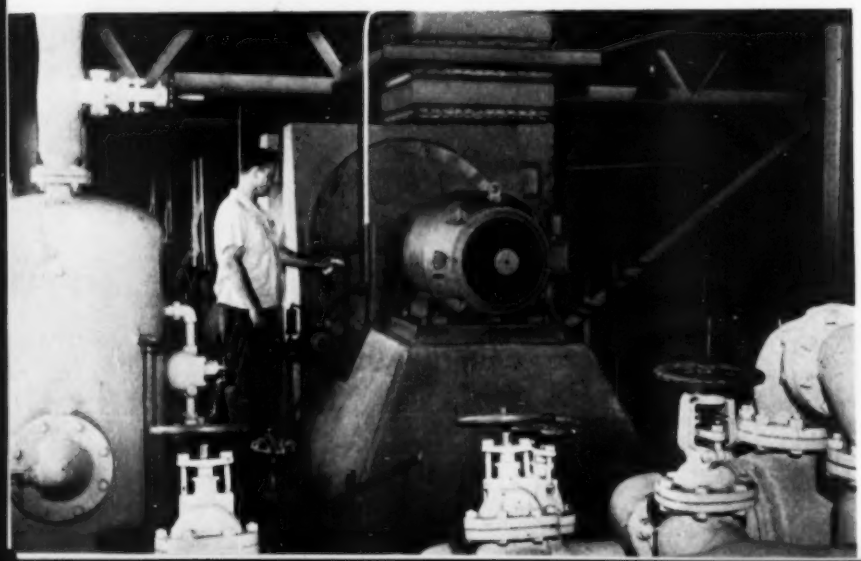


Dust collectors separate coarse particles for reinjection, fines for disposal.

Feedwater system includes a hot process softener, two filters, and four pumps.

Phosphate feed pumps for secondary treatment adjoin the ash removal system.

The continuous blowdown system flash tank is on the induced draft fan floor.



along the bottom of the bunker, and transfers it to the stoker hoppers. Each stoker has two, overthrow feeders and a traveling grate, which discharges the ash continuously at the front of the unit. Overfire jets in the rear wall and careful control of the primary air distribution under the grates has enabled these units to carry a wide variety of loads. In the summer there are times when steam flow is negligible but the stokers still operate satisfactorily without creating any smoke nuisance.

Dust Collection

Additional economy is obtained through the use of decantation type dust collectors between the boiler outlets and the induced draft fan inlets. With this type of collector, the coarser particles with some heating value are reinjected into the furnace while fine particles pass directly to the ash disposal system. Reinjected particles enter the furnace through the overfire air jets in the rear wall, and this arrangement prevents excessive dust loading in the gases.

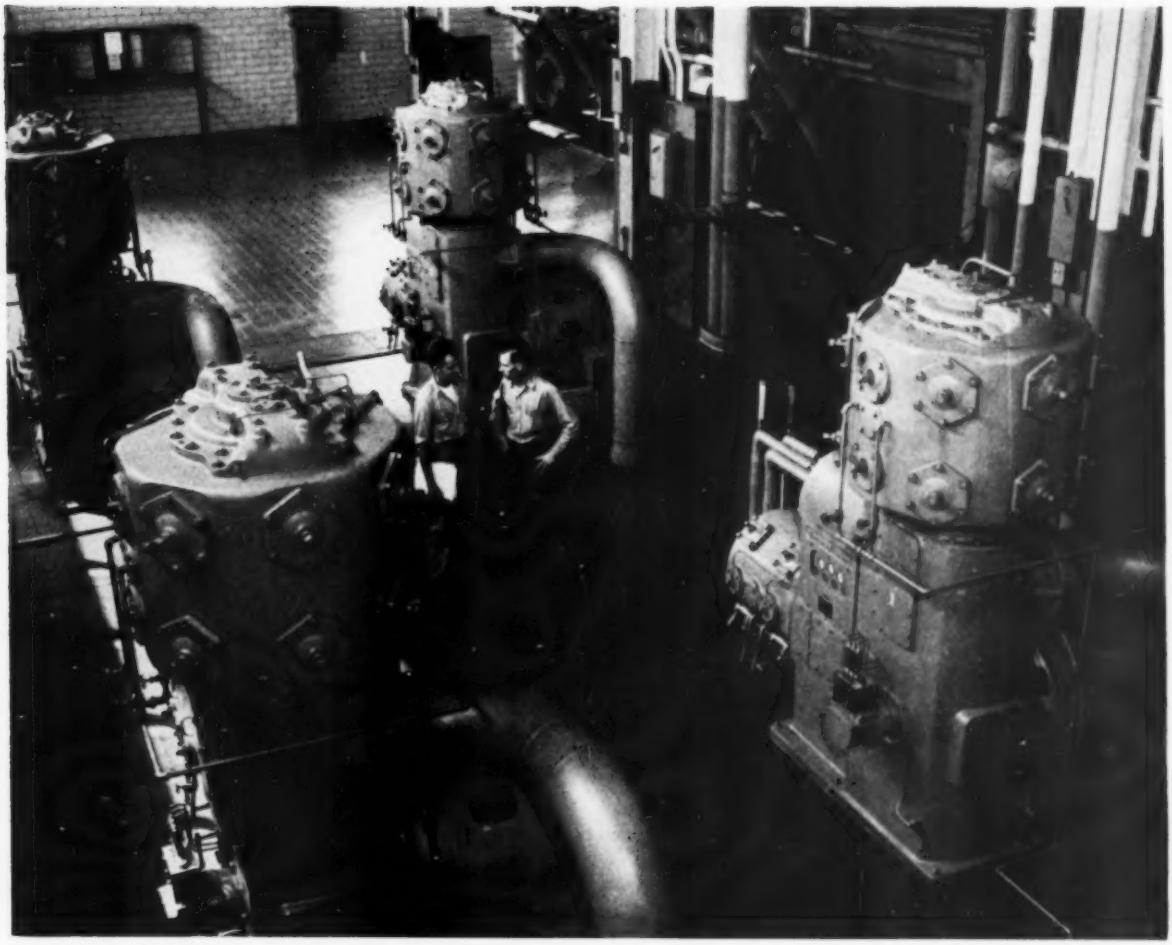
The plant utilizes a steam actuated, pneumatic ash handling system. This equipment, installed in the boiler house basement, receives both the ash from the stoker grate and the fine particles from the dust collectors. In addition, a vacuum cleaning system, installed to facilitate housekeeping, also discharges into the ash removal system. Collected ash and dust are carried to an outdoor, tile silo. This unit is elevated so a truck can drive underneath to receive the ashes. The silo has a dustless unloader equipped with water sprays.

Water Supply

Water for both the boiler plant and the manufacturing area is obtained from the City of Detroit. Service lines enter the boiler house basement where the water is picked up by two, motor driven, centrifugal booster pumps that raise the pressure from 45 to 55 psig and distribute it to various sections of the plant. Principal water uses at the service center are boiler makeup, fire protection, air compressor cooling, and waste disposal.

Fire Protection

Water for the fire protection system is stored in two tanks. A spheroidal sprinkler tank 145-ft high holds 200,000 gallons, of which 100,000 gallons is for domestic use. In an emergency, however, this tank's entire capacity could be utilized for fire fighting. The other tank is a vertical unit at ground level which contains 300,000 gallons. This volume is

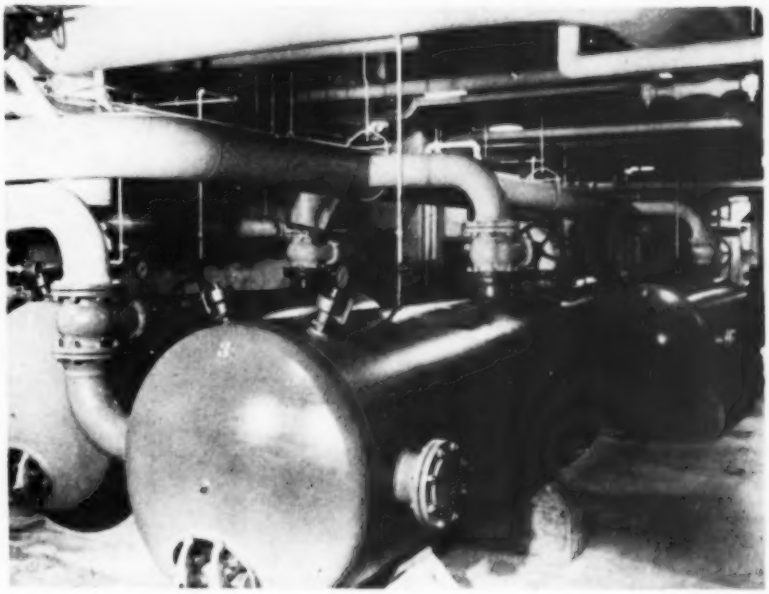


Four, 1000-cfm, heavy duty, double acting, cross head type, two stage compressors furnish air for manufacturing operations.

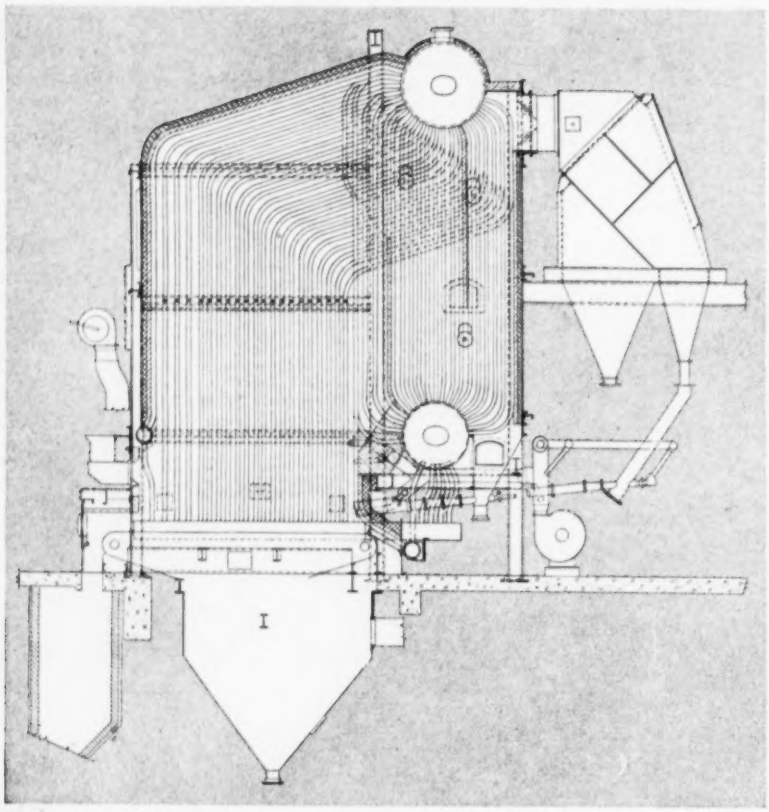
reserved solely for fire protection.

A small, motor driven, centrifugal leakage pump maintains 80 psig pressure on the sprinkler system under normal conditions. If the pressure drops below 70 psig, the main, motor driven, centrifugal fire pump automatically starts. This unit operates until normal system pressure has been restored. In addition, the plant's auxiliary equipment includes a diesel engine driven, centrifugal fire pump for emergency use in the event of a power failure.

During the summer, approximately 70 percent of all steam supplied to the manufacturing area is returned as condensate. The balance, contaminated by process operations, flows to the waste disposal system. In the winter, when all heating steam is returned, condensate is 85 percent of the total boiler feed. With these relatively large return volumes, only a limited amount of exhaust steam from auxiliary drives is required for feedwater heating. Thus, all plant



Each compressor unit has a separate air receiver and an in-line aftercooler.



Drawing shows arrangement of boiler, stoker, collector, and reinjection system.

auxiliaries except the feedwater pumps are motor driven.

Primary Water Treatment

Makeup water from the supply system is pretreated in a hot process lime-soda softener and passed through two, pressure type filters. The softener is a combination unit with separate deaerating sections for condensate and makeup. It also has an integral storage compartment. Feedwater temperature is controlled at 220F by bleeding live steam into the heater whenever there is not enough exhaust steam from the feedwater pump turbines to maintain this level.

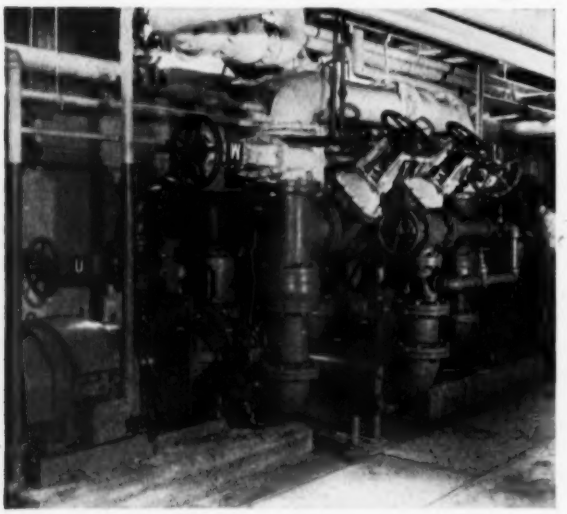
The plant has a total of four feedwater pumps, three centrifugal and one steam reciprocating. Two of the centrifugal pumps are steam turbine driven, and the third has an electric motor drive. Each of the centrifugal pumps has a capacity of 200 gpm, and the plant normally operates with only one of the steam driven units in service. The steam reciprocating pump, used for light loads in summer and on week-ends, has a capacity of 40 gpm.

Secondary Water Treatment

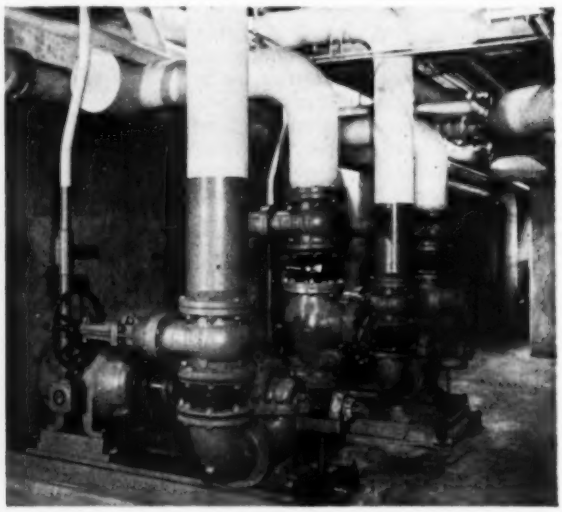
Secondary water treatment consists of trisodium phosphate feeds which enter the top drums of the boilers. The system is arranged for automatic operation using adjustable stroke proportioning pumps. Phosphate is fed for five minutes and then a flushing cycle of ten minute duration is automatically initiated. This flushing cycle, using returned condensate, prevents solid accumulations in the chemical feed lines. Treatment is controlled by blowing down the boilers continuously into a flash tank and heat exchanger. The waste water discharges to the disposal plant while the makeup water, used as the cooling medium, enters the softener.

Combustion Control

Complete electrical combustion control permits fully automatic or manual operation of each boiler. The



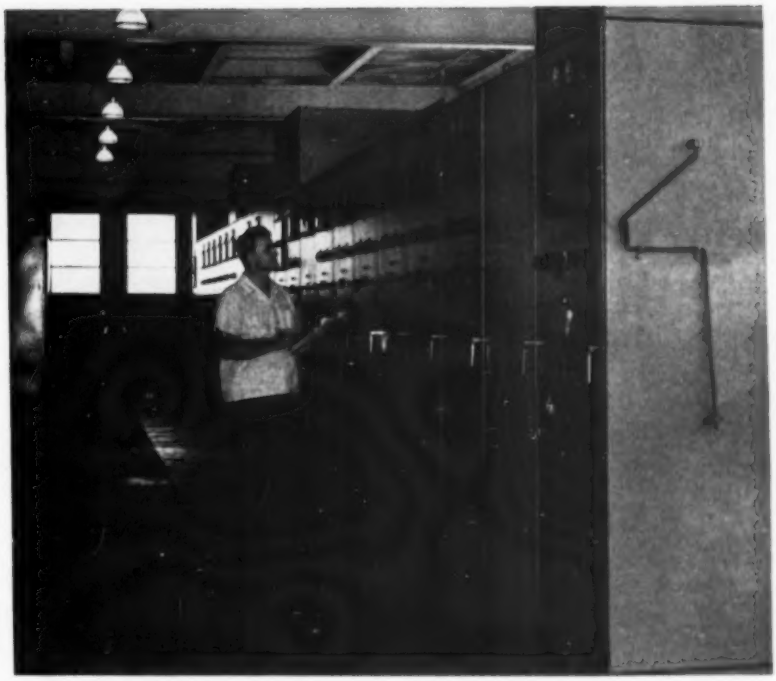
Fire pumps maintain an 80-psig sprinkler system pressure.



Centrifugal booster pumps provide adequate water supply.

system is arranged to maintain constant steam pressure, and an unbalanced condition first calls for an increase or decrease in the firing rate. This is accomplished by regulating the speed of the spreader stoker feeders. Since the fuel feed controller and air flow controller are interlocked, the forced draft fan damper is automatically adjusted for the new firing rate. Furnace draft is independently maintained at a constant value by positioning the induced draft fan dampers.

The main combustion control panel also contains the instrumentation. Boiler efficiency meters, recording steam flow, air flow, and flue gas temperature, are the principal performance guides. These meters also have indicators and integrators for the steam flow. Other instrumentation on the panel includes multipoint draft gages and smoke indicators for each boiler. As a further check on operations, samples are analyzed periodically for CO_2 content using a hand Orsat.



Primary switchgear for the 4160-volt electric service is in the same building.

Compressed Air

Four, 1000-cfm, synchronous motor driven, heavy duty, double acting, cross head type, two stage, water cooled compressors supply the plant's process air requirements. Each of these units is equipped with an in-line aftercooler and a separate receiver in the boiler house basement. The system also includes an induced draft type cooling tower on the roof of the boiler house. Relatively little makeup water is required, although cooling water for the induced draft fan bearings is drawn from the circuit.

Operation of the entire service center has been extremely satisfactory. With all plant utilities under the supervision of the boiler plant personnel, Chrysler is assured of service continuity for their manufacturing operations. Furthermore, all equipment is designed with ample capacity to handle increased loads.

PRINCIPAL EQUIPMENT

Steam generators	Union Iron Works	Primary chemical pump	Ingersoll-Rand Co.
Dust collectors	Prat-Daniel Corp.	Backwash pump	Ingersoll-Rand Co.
Fly ash reinjection	Detroit Stoker Co.	Secondary chemical pump	Hills-McCanna Co.
Soot blowers	Diamond Power Specialty Corp.	Chemical pump motors	General Electric Co.
Spreader stokers	Detroit Stoker Co.	Water system booster pumps	Goulds Pumps, Inc.
Feeder drives	Reeves Pulley Co.	Booster pump motors	Fairbanks, Morse & Co.
Grate drives	Link-Belt Co.	Sprinkler tank	Chicago Bridge & Iron Co.
Stoker motors	General Electric Co.	Water storage tank	Chicago Bridge & Iron Co.
Forced draft fans	Clarage Fan Co.	Fire pump	Peerless Pump Division
Forced draft fan motors	The Louis Allis Co.	Fire pump motor	Electro Dynamic Division
Induced draft fans	Prat-Daniel Corp.	Fire system leakage pump	Peerless Pump Division
Induced draft fan motors	The Louis Allis Co.	Leakage pump motor	Marathon Electric Mfg. Corp.
Fly ash return fans	Buffalo Forge Co.	Air compressors	Ingersoll-Rand Co.
Fly ash return fan motors	General Electric Co.	Air compressor motors	Electric Machinery Mfg. Co.
Stoker cooling fans	Clarage Fan Co.	Cooling water pumps	Goulds Pumps, Inc.
Stoker cooling fan motors	General Electric Co.	Cooling water pump motors	Fairbanks, Morse & Co.
Coal handling system	The Fairfield Engineering Co.	Primary switchgear	General Electric Co.
Coal car shaker	National Conveyors Co. Inc.	Combustion controls	The Hays Corp.
Weigh larry	Fairbanks, Morse & Co.	Instrumentation	The Hays Corp.
Ash handling system	Allen-Sherman-Hoff Co.	Smoke indicators	Advance Smoke Control Co.
Boiler feed pumps (centrifugal)	Aurora Pump Co.	Feedwater regulators	The Swartwout Co.
Boiler feed pump turbines	Whiton Machine Co.	Water columns	Reliance Gauge Column Co.
Boiler feed pump motor	Fairbanks, Morse & Co.	Safety valves	Manning, Maxwell & Moore, Inc.
Boiler feed pump (reciprocating)	Union Steam Pump Co.	Nonreturn valves	Edward Valves, Inc.
Hot process softener	Graver Water Conditioning Co.	Cooling tower	Lilie-Hoffman Cooling Towers, Inc.
Filters	Graver Water Conditioning Co.	Vacuum cleaning system	U. S. Hoffman Machinery Corp.
Continuous blowdown system	Cochrane Corp.	Water consultant	Hall Laboratories, Inc.
Blowdown valves	Yarnall-Waring Co.	Engineering	Albert Kahn Associated Architects & Engineers, Inc.

These batteries are in sub-station float service for circuit breaker control, indicating lights, and emergency lighting.

Understanding Storage Batteries

K. A. VAUGHAN
Manager, Field Engineering
Gould-National Batteries, Inc.

ABOUT 90 PERCENT of American industry's storage batteries are the lead-acid type. There are many sizes and types but they all have the following characteristics: electrical efficiency is high; high and constant voltage characteristics are obtainable; small numbers of cells are required for a given voltage (hence, less compartment space is required); minimum attention is required to keep in good condition; determining the state of charge is easy; the electrolyte need never be changed; higher capacity is available at high discharge rates and at low operating temperatures; and, finally, initial cost is low.

The capacity of a storage battery

Overhead hoist on monorail or small crane is quite useful for moving batteries around; spreader bar between hooks prevents bending battery box.

is expressed in two ways: ampere-hour capacity and watt-hour capacity. The ampere-hour capacity is a measure of the electrochemical capabilities within the cell. It is indicative of the quantity of electrical energy which the battery is able to deliver. A lead-acid battery described as having "300-ampere-hours capacity at the 6-hour rate of discharge" will deliver 55 amperes for 6 hours. This same battery will deliver 192 amperes, or 192 ampere-hours, if discharged in 1 hour; if discharged in 20 hours, it will deliver 420 ampere-hours.

The ampere-hour capacity of the battery increases as the rate of discharge decreases. Because batteries are seldom discharged at a constant rate they are specified to meet the average current requirement over a period of time such as one eight-hour shift. An allowance for peak demands must be made, such as when a battery-powered fork-lift truck must transport a load up an inclined ramp.

The watt-hour capacity is a measure of the energy or the ability to do work. It is obtained by multiplying the ampere-hour capacity by the average value of the voltage during the discharge period.

Service Classes

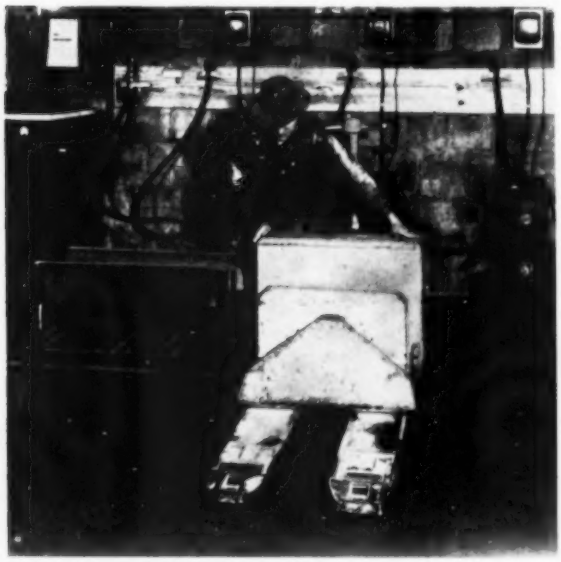
Storage batteries are used for two general service applications — cycle service and float service. Cycle service batteries are discharged by use, charged, again discharged by use, and so on for the life of the battery.

Yoke-hook is used to handle storage batteries where they must be moved in and out horizontally from the carrier, such as is required with this old-timer.

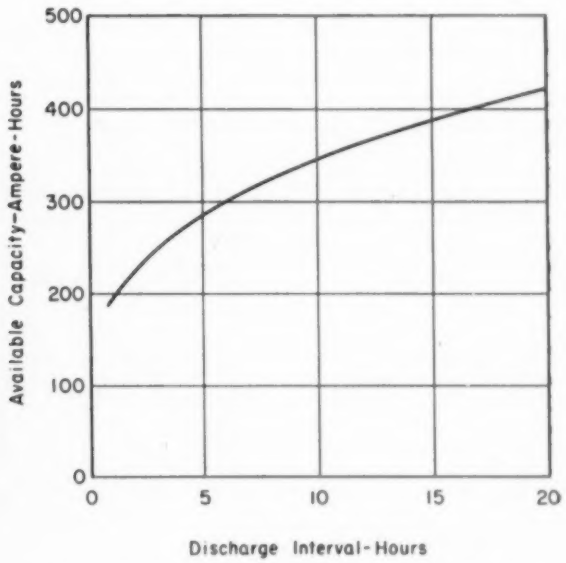
An average lead-acid battery will be partially discharged and charged from 1500 to 2000 times during its life. Typical applications are vehicles such as electric fork-lift trucks and mine locomotives.

Float service batteries are maintained at a constant level of charge to supply emergency power, generally in a stationary installation. They are used in telephone standby circuits, switchgear, and fire alarm and railway signalling circuits. Power is normally from public utilities, however it is taken from batteries during an emergency. The batteries are automatically cut into the circuit when public power fails; the batteries operate the equipment just until the usual power source is once more available.

Plate design for the two types of applications differs in that cycle service plates are usually thin in cross-section whereas float service battery plates are comparatively thick. The



Many plant men devise their own fixtures such as this four-wheeled cart built with a roller conveyor bed.



The ampere-hour capacity depends on the discharge rate; for more rapid rates of discharge, capacity decreases.

penetration of fresh electrolyte into the plate material is limited at high discharge rates, primarily because of a chemical film which forms over the plate surface in proportion to the discharge rate. Diffusion of stronger electrolyte into the plate pores to replace spent electrolyte takes time.

Since the film does not form around the plates as rapidly when the discharge rate is lower, and since there is comparatively more time for electrolyte diffusion at slower discharge rates, plates of batteries which discharge at relatively low rates can be of thicker cross-section. (The diffusion factor also accounts for the lowered ampere-hour capacity of a given battery at high discharge rates.)

Most cycle service batteries operate at moderately high discharge rates for six or eight hours. They require many thin cross-section plates in order to present as much plate surface area to the electrolyte as possible. Float service batteries are generally discharged at relatively high rates for very short periods, and have plates of thicker cross section.

Voltage

Voltage requirements determine the number of cells needed. For example, industrial trucks have motors rated 24 to 30 volts, 30 to 36 volts, and so forth. A 12- or 15-cell battery would probably be chosen for use on a 24- to 30-volt motor, in that the lead-acid cell is rated at 2 volts per cell. It is well to have some excess capacity to prevent over-discharging when the truck is subject to abnormal duty requirements.

The design of battery-powered equipment determines the current which must be available. By figuring how many hours the battery will be in operation, the ampere-hour requirements can be determined. For example, a shuttle car driven by a motor having an ampere drain of 100 amperes would require a 600-ampere-hour battery if it is intended to work 6 hours.

Battery Sizes

Manufacturers generally supply several sizes of batteries which will deliver approximately the same ampere-hours. This is to accommodate equipment having various sizes of battery compartments. The size differences are accomplished by varying both plate dimensions and the number of plates per cell.

The size of the cell specified will depend on the characteristics of the equipment it powers. A battery-operated locomotive in a coal mine requires a low-height battery; a fork-lift truck operating through narrow doorways requires a narrow width battery; and a truck operating where a short turning radius is necessary requires a short-length storage battery.

Battery selection must also take account of service conditions. The number of hours the equipment is to operate, or the duty cycle, is a factor to consider. For example, a 4,000-pound capacity industrial truck might operate for only a few hours under light load and level floor conditions or it might operate a full shift under heavy conditions and have to climb ramps. Different capacity batteries would be required. Care must be taken to provide adequate ampere-hours capacity for the service required including the abnormal demands.

Larger capacity batteries in some cases provide two day's operation without recharging. This insures long battery life, lower primary power consumption, and lessens time out of service required for changing and charging batteries. Since each type of cycle service battery is operated under different conditions, both equipment and battery manufacturers should be consulted about the size of battery required under specific circumstances.

Charging Equipment

It is necessary when specifying batteries to consider charging equipment. In a new installation, the capacity of the battery-powered units and of the batteries automatically determines the capacity of the charging equipment. However, when installing additional battery-powered equipment, the existing charging equipment must be considered.

The present batteries might be the 300-ampere-hour size; because of additional requirements, they now may be capable of delivering only a half-day's work. This makes it necessary to charge the battery during the shift, imposing lost shift time. New equipment probably would be designed for 600-ampere-hour capacity to reduce the time lost in battery charges; but it will be discovered that charging equipment has not sufficient capacity to charge the larger-size batteries. This problem can be solved by purchasing additional charging equipment of higher capacity or retaining the old charging equipment and doubling the number of small batteries.

Another factor which sometimes enters the picture is the temperature at which the battery operates. The battery produces current by chemical reaction. The speed of the reaction increases as temperatures rise, and will be retarded as temperatures drop. At full charge, a battery delivers but 65 percent rated capacity at 32 F; it delivers 40 percent at 0 F; but 105 percent is delivered at 100 F. This is primarily related to the fact that the electrolyte diffuses more readily during discharge because of the decreased electrolyte viscosity at the higher temperature.

Ventilation

Ventilation should be provided for batteries which will be operated in high-temperature locations, either due to climate or due to high-temperature equipment near the battery. Louvers are often designed into battery boxes, and batteries are often elevated from the bottom of compartment by structural members. In cases of extremely cold temperatures, insulation can be provided as an integral part of the battery compartment.

Although it does not enter into the selection of a battery, the plant engineer should be familiar with the fact that temperature is important in battery charging. If the battery is charged too rapidly, the chemical reaction which takes place during charging will give off heat. This will cause the electrolyte to "gas" and will cause water to evaporate from the electrolyte. Continued high charging rates will have damaging effects on plates of the battery.

Vibration

Vibration is seldom a serious factor in the selection of industrial storage batteries. Specific mechanical devices — springs or other vibration mountings — may be installed to absorb the vibration. Otherwise, terminals or vent plugs may be shaken loose, excessive sediment may be produced by electrode paste shaking loose from the plates, or plates may be broken.

The weight of the battery is a factor to be considered in choosing battery equipment. For instance, when used in industrial trucks, the battery acts as ballast and contributes to the effect of the lead counterweights.

The types of charging plugs, length of charging lead, and types of cable connectors should be considered in advance to avoid makeshift arrangements by equipment operators. This is particularly true when replacement units are purchased.

High Stacking Affects Fork Truck Stability

HAROLD MILZ
Chief Engineer
Mercury Manufacturing Co.

PRESENT HIGH COST of building new or additional storage facilities has re-emphasized the desirability of stacking materials in storage as high as is practical and safe. It is becoming increasingly important that every materials handling engineer "utilize the cube" to the best possible advantage. This urgency has resulted, upon occasion, in the placing of a premium on the stacking heights of fork trucks without due regard to the hazards and limitations involved.

It is general practice to leave the problems of fork truck stability to the manufacturer of the truck. The operating conditions are outlined and a truck is designated that will do the job. This is sound practice and works out well if the original job specifications are complete and are accurately determined and transmitted. Many times overlooked is the fact that lighter loads can cause stability trouble if those loads are longer than anticipated, or if they are odd shapes and their centers of gravity fall too far forward. It also is true that heavier loads may put undue strain upon tires, brakes, wheel bearings, and the hydraulic system.

The average plant engineer therefore must not only understand the factors that affect truck stability, but should be familiar with the formulas involved and how they can be applied to his everyday materials handling problems.

Fork Truck Stability

Fork trucks carry the load ahead of the wheels in cantilever fashion. Therefore, the downward force is in front of, not over, the points of support. The fork truck can be considered as a simple lever, Fig. 1, with the center of the front drive wheels acting as a fulcrum point between the load and the counter-balancing action of the truck's weight.

Thus, the trailing moment—the truck weight back of the forward wheels, multiplied by its lever arm, (C x D) must always be appreciably greater than the forward moment—the load weight, A, multiplied by the length of its lever arm, B. Or C x D must always exceed A x B. If it does not, the truck becomes unstable and tips forward.

The principal factor determining the load that can be transported and tiered is the amount of weight remaining on the trailing wheels when the loaded truck is tilted fully forward at the extreme limit of its lift capacity. To assure sufficient weight remaining on the trailing wheels, the truck wheel base or the counterweight, or both, can be increased.

Lengthening of the wheel base is limited, however, since it can be accomplished only at the expense of

High construction costs for storage facilities have re-emphasized the desirability of stacking materials in storage to the maximum safe height.

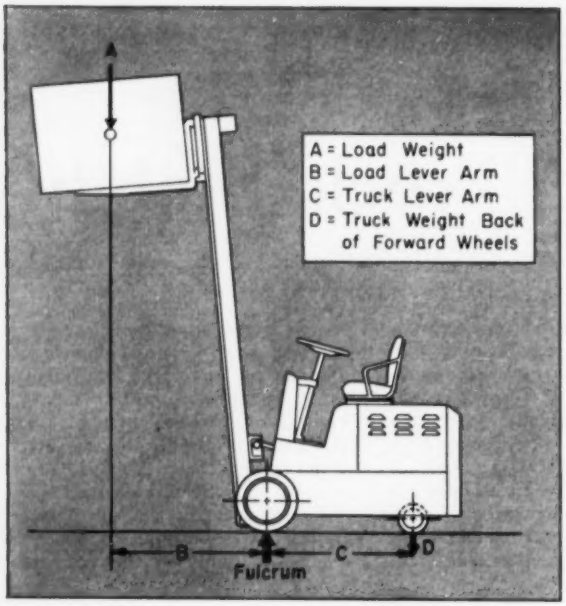


Fig. 1 — Drawing demonstrates lever principle of a fork truck, with the front drive wheels acting as a fulcrum.

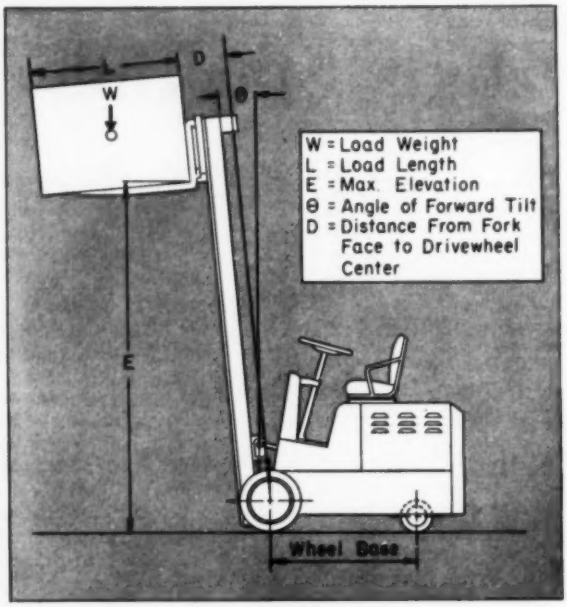


Fig. 2—Measurements shown above are required to calculate the forward overturning moment for given load.

maneuverability. In addition, aisle widths do not usually permit unlimited wheel base extension.

Weight that can be carried on the trail axle is likewise limited. It is limited not by axle design, but by both the amount of effort and the number of hand turns that an operator can be expected to make in steering a truck—unless power-steering devices are used.

Design of trucks, therefore, is governed not only by capacity and wheel base, but also by steering effort and stability. It is generally accepted that steering becomes too difficult for good operation when the trail wheel weight exceeds 7500 lb.

In order not to exceed this figure, and yet to include sufficient weight to permit full forward tilt at extreme elevation (in other words, to determine the trail wheel weight required to provide adequate stability under all normal operation conditions) it is necessary first to calculate the overturning moment.

Calculation of Overturning Moment

An overhanging load on a fork truck creates a forward overturning tendency. This tendency may be calculated by multiplying the load weight by the distance from fulcrum point to load when elevated and fully tilted forward. Such a product is called the overturning moment, and is expressed in units of inch-pounds. For convenience, the calculations can be divided into load, loss, and tilt moments, the sum of which equals the total overturning moment.

Referring to Fig. 2, load moment is the product of the load weight, W, and one half of the load length, L, measured parallel to the forks. This moment is one of the terms commonly used to define the capacity of a fork truck.

Loss moment is the product of the load weight, W, and the distance from the fork face to the drive wheel center, D, measured with the mast in a vertical position. This dimension is a constant for any one truck model.

Tilt moment is the product of the gross weight of the pay load, W, times the height of the vertical center of the load times the sine of the forward tilt angle. To simplify measuring, the maximum fork elevation, E, is usually used in place of the measurement to the center of the load. Although approximate, this figure is accurate enough for practical purposes.

Use of this information is best shown by an example, such as determining the trail weight necessary on a properly-designed fork truck bearing a nameplate rating of 144,000 in.-lb and handling a 6000 lb, 48-in. long load. The truck is assumed to be a standard model lifting to a height of 115 inches with a forward tilt of 5 degrees. The manufacturer's literature specifies a 54-in. wheelbase, with 18 inches from the fork face, or back end of the load, to the drive wheel center.

Calculations are as follows:

$$\text{Load Moment} = W \times \frac{L}{2}$$
$$= 6000 \text{ lb} \times \frac{48 \text{ in.}}{2}$$
$$= 144{,}000 \text{ in.-lb}$$

$$\text{Loss Moment} = W \times D$$
$$= 6000 \text{ lb} \times 18 \text{ in.}$$
$$= 108{,}000 \text{ in.-lb}$$

$$\text{Tilt Moment} = W \times \sin\theta \times E$$
$$= 6000 \text{ lb} \times 0.0872 \times 115 \text{ in.}$$
$$= 60{,}375 \text{ in.-lb}$$

Therefore:

Overturning Moment, O. M. = 312,375 in.-lb

Calculation of Trail Weight

The next step is to calculate the amount of weight subtracted from the trail wheels under these conditions. This is done by dividing the overturning moment by the truck wheel base. The amount of weight subtracted from the trailing wheels is therefore:

$$\frac{312{,}375}{54 \text{ in.}} = 5785 \text{ lb}$$

The questions which follow are: Is this weight adequate for safe operation under all normal conditions? If not, how much additional weight is required?

Up to this point, only static stability has been considered. Actual use of the truck, however, involves movement and consequently requires consideration of additional dynamic forces. This movement may include bringing the truck to a

quick stop when carrying the load at slightly elevated position, or cautious maneuvering as required in the tiering operations. It does not allow for traveling at full speed with the load elevated—a practice prohibited by all safety programs. These additional dynamic forces require extra weight on the trail wheel.

Dynamic forces are more difficult to determine than simple overturning moments. They require a knowledge of the exact location of the combined center of gravity of truck and load as well as the exact rate of deceleration. However, when stacking is done up to 12 feet—which covers by far the largest percentage of all trucks in use today—a simple empirical formula, which works out well in practice, has been developed to take care of these forces. In those rare cases where higher lifts are involved, additional consideration must be given to the serious problems of stability that are created. When elevating up to 12 feet, the additional trail weight required to offset these forces equals one-tenth of the load weight plus 600 lb. This 600 lb is a constant regardless of load weight. In the foregoing example, which has a load weight of 6000 lb, this figure will be 1/10 of 6000 lb plus 600 lb, or 1200 lb. The sum of this figure and the previously-determined figure of 5785 lb, calculated for static stability only, equals the final required trail weight of 6985 lb.

Manufacturers' literature now can be consulted, or inquiries can be made to determine whether the contemplated truck meets performance requirements. In the example given, the required trail weight falls well within the 7500 lb limit mentioned earlier as required for easy steering.

Use of Data

An understanding of the factors involved in truck stability serves a dual purpose when purchasing new trucks. First, it aids in checking maximum loads and tiering height so that accurate information can be given to the manufacturer.

Secondly, it enables specifications of competitive trucks to be checked and compared in order to prevent purchasing of a somewhat lower cost unit at the sacrifice of adequate stability.

An analysis of truck stability factors also makes clear that static stability remains constant, regardless of how high the load is lifted, when the truck is on a level floor and the mast is in a vertical position. Not one inch-pound is added to the overturning moment, nor is one pound subtracted from the trail weight, when loads are lifted straight up. The very slight forward shift in load center due to mast deflection and clearance in the mating mast parts is readily compensated for by tilting the mast.

However, there are other conditions such as depressions or grades in floor surfaces, deflection of rear springs, whipping of the uprights, and shifting of the bearings while under load, which may throw the mast out of its true vertical position. These factors must also be taken into consideration when computing fork truck stability.

Operation

When a fork truck operator has a heavy load high in the air, he can be compared to a professional juggler balancing a heavy object. If the operator could sense the balance of his load as skillfully as the juggler does, he could probably go three times higher in his stacking.

Since the point of support must be kept under the load for stability, the mast should never be tilted forward when carrying a load in the elevated position. Tilting the mast backwards, on the other hand, shifts the center of gravity too far to the rear, thus causing a loss of side stability. The best compromise is to tilt backward one foot or so, or at least far enough backwards so that deflection of tires, springs, uprights, and other parts of the machine will not allow the back edge of the load to be farther forward than the front face of the drive tires. The juggler's idea is still in force, since the load must be over the point of principal support—the front wheels.

In addition, turns with the load in full elevated position should be avoided, since the truck may turn over sideways. If possible, turns in the aisle should be made with the load at intermediate height. Also, rapid acceleration or braking should be avoided when the load is high. Whenever possible avoid carrying the load in an elevated position.

Gasoline Powered Fork Truck Used Safely in Cold Storage Rooms

AS THE RESULT of a catalytic device recently developed to remove carbon monoxide and hydrocarbons from exhaust fumes, gasoline and LP gas driven fork trucks now can be operated in complete safety within confined areas.

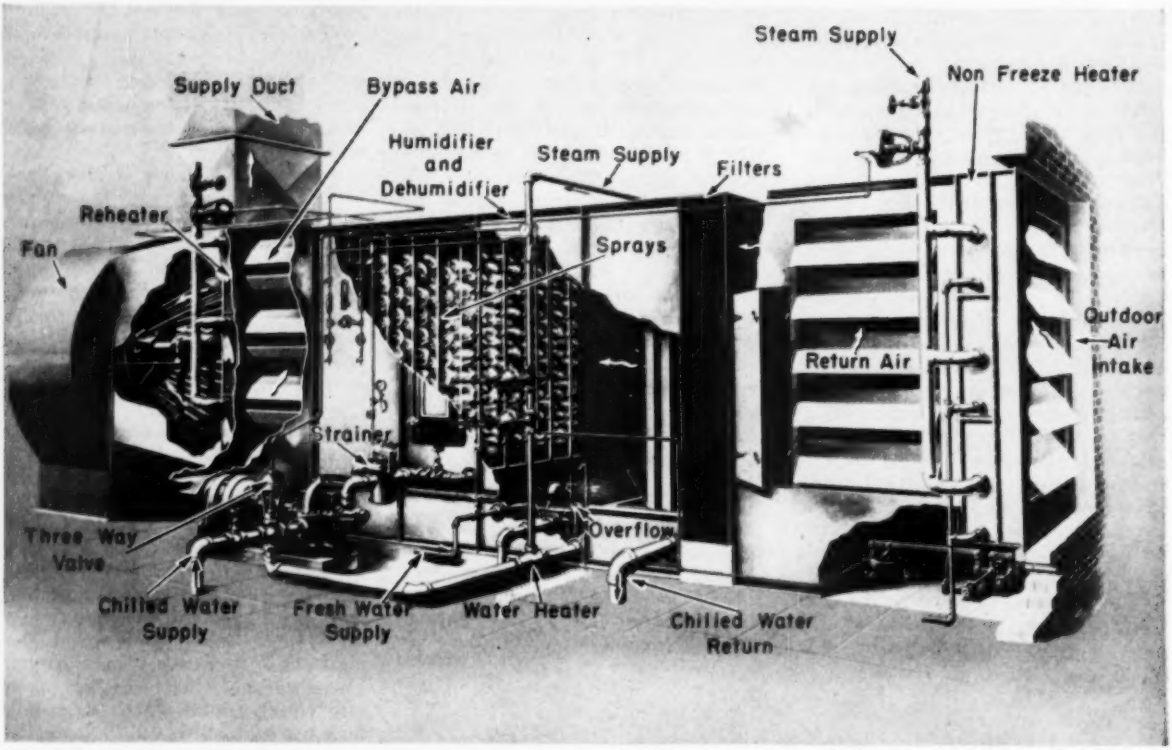
An interesting application of this device has been reported by Farmers Storage Company, Inc., Morrestown, N. J. To speed its materials handling, the firm recently purchased a 2000-lb fork lift truck to pick up palletized loads and paper drums of food at its loading docks and deliver them to its cold storage rooms. The company operates three refrigerated rooms at this plant. The largest room measures 114 x 100 x 15 ft, and the two smaller rooms measure 100 x 48 x 15 ft.

After the new truck was placed in operation, it was found that the exhaust fumes sickened workmen when the truck was operated inside the cold storage rooms. In addition, there was considerable danger of contaminating the foods.

The company solved its problem by replacing the muffler of the fork truck with a three-cartridge catalytic exhaust unit manufactured by Oxy-Catalyst, Inc. This device attracted widespread attention last spring when it was displayed at the Fifth National Materials Handling Exposition (see I & P—June '53, p 124).

It was found that the catalyst oxidized more than 95 percent of the carbon monoxide and hydrocarbons in the exhaust fumes, turning them into harmless carbon dioxide and water vapor. Although the truck is now being operated inside the three storage rooms almost continuously during the working day, the ill effects from the fumes, previously experienced by the employees, have not reoccurred. In addition, it has been noted that odors which might contaminate the foodstuffs also have been eliminated.

The catalytic unit has been designed to replace the muffler on any mobile or stationary engine which burns unleaded gasoline or LP gas. The noise level is comparable to that of regular mufflers, and back pressure is often less.



Carrier Corp.

A schematic diagram of a central station air conditioning system with cutaways showing flow of steam, air, and water.

Water in Air Conditioning Systems

CHARLES BIRD, Genl. Mgr.
The Bird-Archer Co.

An efficiently operated air conditioning system using circulating water must maintain a high rate of heat transfer. Scale formations, biological slime growths, and other forms of corrosion cannot be tolerated.

IN AIR CONDITIONING systems, where the fresh water makeup is not naturally corrosive, the water will eventually become corrosive because of gases absorbed from the air such as oxygen, carbon dioxide, and sulfur dioxide. In industrial areas, water in the air washer may absorb sufficient carbon dioxide and sulfur dioxide to lower the pH value from 6.8 to 3.8 in one day's operation.

Sufficient data have been accumulated to show that the corrosion of air conditioning equipment depends on the following factors:

1. Quality and chemical composition of fresh makeup water to system.
2. Absorption by the circulating water of such impurities as carbon dioxide or sulfur dioxide, both of which are acidic in nature.
3. Saturation of circulated water with dissolved oxygen in the water.
4. Dissimilar metals in contact.
5. Impingement of high velocity water spray on metal surfaces.

If hard water is used in the system, scale formation is also a problem. The deposition of hard water scale may be especially troublesome in the refrigerant condenser cooling water system, where dissolved mineral salts concentrate as the result of continual evaporation. During the summer months, when the air conditioning system operates as a dehumidifier, the circulated wash water passes through the refrigerating machine. Here the rate of heat transfer is of first importance, and scale formation cannot be tolerated.

Biological slime growths present another problem in air conditioning systems. In addition to corrosive gases absorbed by the water in the washer and cooling tower, particles of dust, bacteria, pollen, molds, and algae are absorbed. These materials form deposits that may impart odor to the air, foul the refrigerating system, materially reduce the rate of heat transfer, and contribute to the plugging of the spray nozzles in both the air washer spray chamber and the cooling tower.

Unfortunately, a chemical and bacteriological examination of the fresh water supply is, in itself, not a positive indication of whether or not corrosion and slime growth may be expected in an air conditioning system unless the water naturally possesses

corrosive characteristics or is highly contaminated with bacteria. This is generally not the case. Since air conditioning provides a clearer, purer, more sanitary air supply, it is evident that the impurities originally contained in the air are absorbed by the water which is used to wash the circulated air. Therefore, in addition to an analysis of the fresh water used for makeup, it is necessary to examine the circulated water in the system to determine the nature and degree of impurities it contains before corrective treatment and control can be instituted. Examination of the circulated water should be made when the water is discharged from the system. An analysis of the water at this time will, in part, indicate the maximum concentration and the nature of impurities contained in this water between draining periods and will serve as a guide to proper treatment. Experience has indicated that with proper water treatment, difficulties arising from corrosion, scale, and slime growths can be minimized.

Preventing Corrosion

With respect to the prevention of corrosion in air conditioning equipment, past practice has shown that the pH value of the circulated water should be maintained between 8 and 9. This may be accomplished by the use of an alkaline chemical such as caustic soda or soda ash. However, it does not necessarily follow that corrosion will not occur if the pH value of the circulated water is maintained at that level. In addition to maintaining proper alkalinity for neutralizing absorbed acidic gases, the treatment should passivate the metal. Excluding dissolved oxygen from the water will reduce corrosion to a minimum. However, this is very difficult in air conditioning equipment, and it is necessary to resort to the use of chemical passivating agents such as sodium dichromate and sodium chromate. Laboratory and field tests have demonstrated that these two chemicals effectively inhibit corrosion by dissolved oxygen.

Biological slime growths are inhibited by the use of germicidal agents such as sodium pentachlorophenate and chlorine. However, chlorine is not usually employed in the air wash water system as its use might impart an objectionable odor to the washed air. Its use is restricted to treatment of the refrigerant condenser cooling water.

Usually, hard water scale deposition is not a problem encountered in the recirculated air wash water system. But it does present a problem in the refrigerant condenser cooling water circuit. To prevent scale deposition in cooling towers and condensers in hard water areas, it is common practice to utilize surface active chemicals such as polyphosphates, which act to increase the solubility of the scale forming salts. In addition to preventing scale deposition, these polyphosphates, when used in proper concentration, inhibit corrosion. Blowdown from the cooling water circuit is regulated to limit the concentration of dissolved minerals in the water.

In some water supplies containing very high concentrations of calcium bicarbonate hardness, it may be necessary to resort to acidification of the water. Sulfuric acid is used to convert the calcium carbonate, which has a very low solubility, to calcium sulfate, which has a relatively high solubility (1700 ppm). In extremely bad water areas, it may be necessary to first soften the water externally either by lime or zeolite softeners.

Practice indicates that the concentration of sodium chromate used as a passivating agent should be maintained between 400 and 600 ppm; the concentration of sodium pentachlorophenate between 20 ppm and 30 ppm, to control biological slime.

Polyphosphate Treatment

When polyphosphate treatment is used in the refrigerant condenser cooling water system for the prevention of scale and corrosion, the concentration of polyphosphate should be maintained at 20 ppm and the pH value held between 6.5 and 7. If it is necessary to employ a germicidal treatment to inhibit slime and algae growths in conjunction with the phosphate treatment, chlorine must be used, as sodium pentachlorophenate is not soluble at a pH below 6.8. The chlorine can be applied to the system as gaseous chlorine or in solution in the form of sodium hypochlorite. Sufficient chlorine should be added to maintain a minimum chlorine residual of 1 ppm in the cooling water at all times.

Chromate, sodium pentachlorophenate, polyphosphate, chlorine, and pH values can be determined by simple colorimetric tests employing readily available and inexpensive apparatus.

Operating Precautions

The success of chemical treatment of water in any central station air conditioning system depends, to a large extent, on the observance of the following practical precautions:

1. A well designed and well maintained valve and control system for the makeup water to the circulating system. (A leaking makeup water valve results in excessive use of water and chemicals.)

2. Circulating pumps in best operating condition. Check pumps periodically to be sure they are free of obstructions and delivering proper quantity of water.

3. Periodical inspections of spray nozzles and cleaning when necessary.

4. Regular removal of accumulated dirt and sediment from spray chamber, cooling tower, and refrigerant condenser equipment.

5. Eliminator plates in spray chamber thoroughly washed down at scheduled intervals.

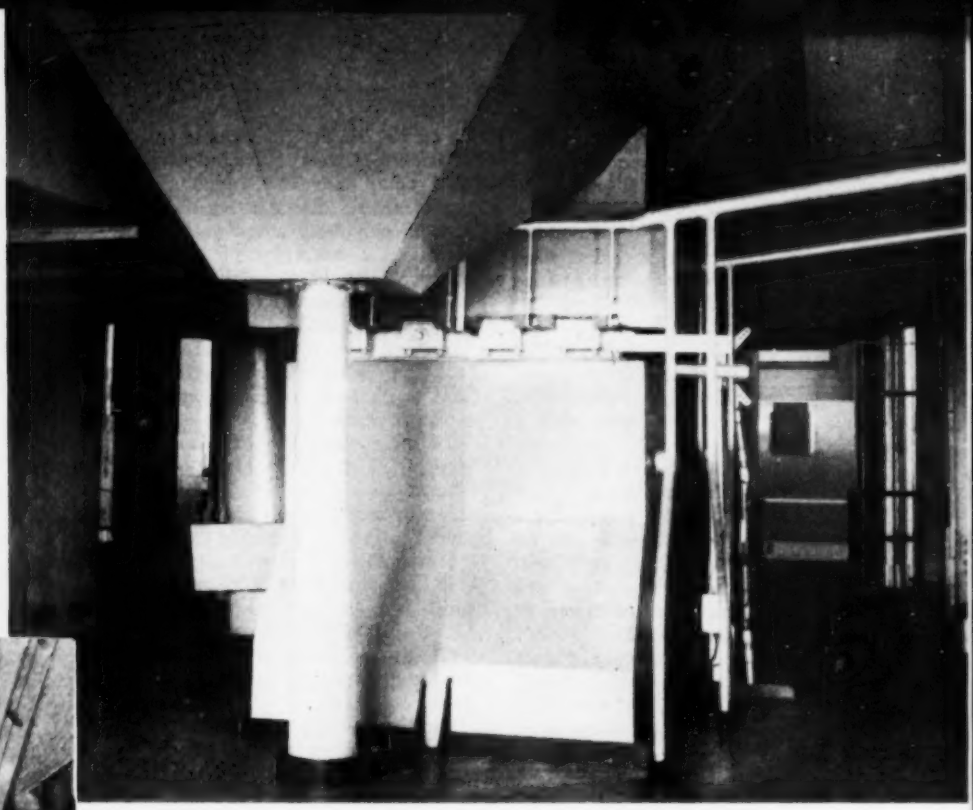
Properly selected chemicals for treating the water in air conditioning systems do not ordinarily contaminate the conditioned air. If contamination does occur, it is an indication that the air washer chamber does not have sufficient eliminator surface.

Portable Ventilation

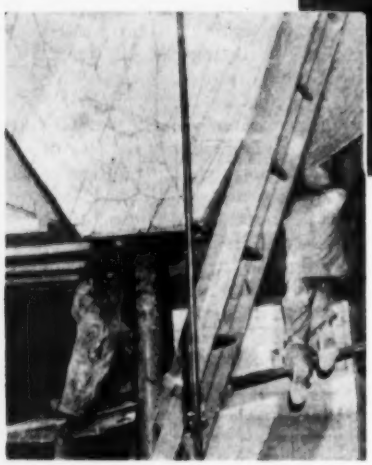
PORTABLE AIR MOVERS—venturi type devices—used by the Paint Department of Dravo Corporation, Pittsburgh, have proved to be versatile, time-saving, and economical in providing on-the-spot ventilation in interior painting of barges, towboats, and tanks or compartments, to prevent accumulation of paint fumes.

The air mover is horn-shaped, with a bell-formed base, and weighs only 31 lbs. Compressed air is introduced through the annular orifice in the base and is discharged at high velocity from the outlet horn. This induces a large volume of air movement. The air movers used by Dravo have a rated discharge capacity of 3150 cubic feet per minute at 70-lbs. compressed air pressure. Although compressed air is used in this case because it is more readily available, steam may also be used.

Initial cost of the units is reported to be very low compared with motor-driven units of similar capacity—usually about one-tenth the cost of an electrically driven explosion-proof blower and exhauster. Upkeep cost is practically negligible since there are no moving parts to replace or maintain it is pointed out by engineers of the air mover manufacturer, Mine Safety Appliances Co., Pittsburgh.



Workmen wired blocks of 85 percent Magnesia to the air preheater and recirculating gas fan, below. Then a metal jacket, right, was applied to protect the insulation from possible external damage.



Engineered Insulation

Cuts Heat Loss at E. H. Werner Station

GEORGE H. RITTER
Production Department
Jersey Central Power & Light Co.

IN 1931 the E. H. Werner Station (South Amboy, N. J.) of the Jersey Central Power & Light Co. became the first station to have a vertical compound turbine-generator set. This year, in the midst of its $100 million, ten-year, post war expansion program, the utility set another precedent at the same plant. It installed the first steam generator with a "Cyclone" furnace in the East.

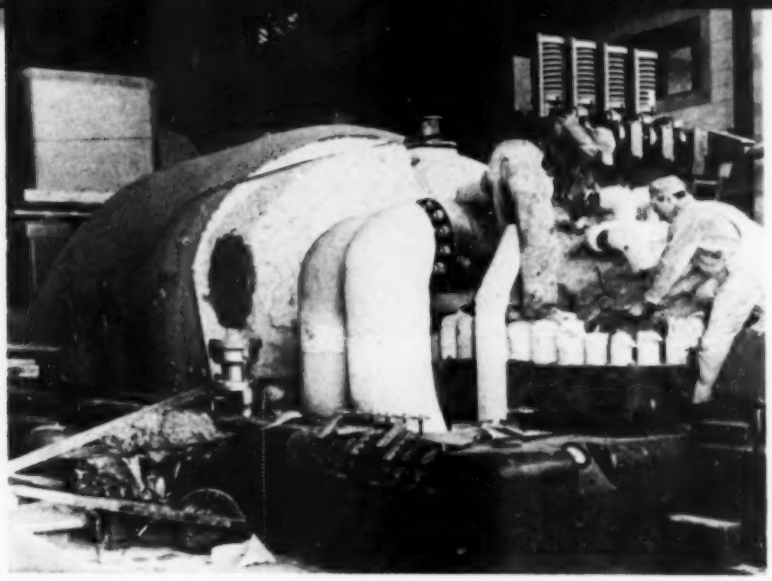
The system, serving an area which extends approximately from the Raritan River to Barnegat, and from the Atlantic Ocean to Hightstown, has experienced tremendous growth. In one decade, the yearly kwh output has almost doubled, increasing from a gross generation of 540 million kwh in 1942 to nearly a billion kwh in 1952. Peak loads for the same years were 94,000 kw and 225,000 kw respectively.

A few years ago, when the load demand started to climb rapidly, the Jersey Central Power and Light Co. initiated an expansion program. Burns & Roe, Inc. was retained to add some 12,000 sq ft of floor area and to install new generating capacity at the E. H. Werner Station, and also to enlarge facilities at the

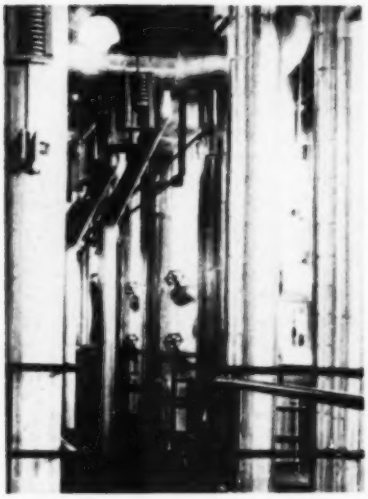
TABLE 1 — DETAILS OF INSULATION ON BOILER AUXILIARIES

Unit	Temperature deg F	Insulation, in. ds*	M**
Closed feedwater heater No. 6, shell	850	2	2
Closed feedwater heater No. 5, shell	700	1½	2
Closed feedwater heater No. 4, shell	825	2	2
Deaerating heater No. 3, tank and vent condenser	385		2
Deaerating contact heater No. 2, shell	300		1½
Evaporator	385		2
Evaporator condenser, shell and water box	385		2
Evaporator preheater, shell	385		2
Evaporator flash tank, shell	385		2
Evaporator drain pumps	300		1½
Drain recovery pumps and tanks	250		1½
Boiler feed pumps	315		2
Fuel oil pump and heater set	300		1½
Condensate pump, third stage	300		1½
Hot water storage tank	160		1½

*Diatomaceous silica **85 percent Magnesia



Turbine surfaces are covered with diatomaceous silica and 85 percent Magnesia.



Aluminum jackets were applied to the steam lines and heater shells.

The tops of the feedwater heaters are finished with asbestos cement.

company's Raritan River plant. These projects will assure the comfortable reserve over consumer demands that the system has maintained to date.

New equipment installed in the E. H. Werner Station includes a Babcock & Wilcox radiant-reheat boiler, which has a continuous rating of 475,000 lb of steam per hr or a short time (4 hour) rating of 520,000 lb per hr. Crushed — not pulverized — coal is fired in the Cyclone furnace. This unit produces steam at a pressure of 1700 psig and a total temperature of 1000 F. Reheat temperature also is 1000 F. The steam (at 1650 psig) is fed into a 62,500 kw, 3600 rpm, General Electric turbine-generator which has six bleed stages and exhausts into a condenser at 1 in. Hg absolute.

Prior to the new construction, 1.13 lb of coal were required per kwh whereas now the estimated fuel consumption is a shade under one pound. Much of this reduction is due to the use of higher steam pressures and temperatures, and also the fact that inherent efficiencies of boilers and auxiliaries have increased. However, a part of this improvement can be attributed to more careful engineering of the plant's insulation needs, which greatly reduces heat losses.

In the old section of the E. H. Werner Station erected in 1931, the temperature of the primary steam going to the high pressure turbine was 750 F. This steam passes through a 14 in. main which is covered with a combination insulation — diatomaceous silica and 85 percent Magnesia — to a total thickness of 3 in. Conditions prevailing in the new addition make an interesting comparison. There, an equivalent pipe, having the same diameter and operating temperature, was insulated with a combination insulation 4 in. thick. By balancing the cost of the additional inch of insulation against the cost of heat it would save, the extra thickness was found to be justified.

Insulation Materials

On all equipment and piping surfaces with temperatures between 151 and 550 F, 85 percent Magnesia was applied. Some surfaces between 86 and 150 F also were covered with 85 percent Magnesia, not so much from a consideration of heat savings but rather to keep the temperature within the station at a comfortable level and to protect the operators against burns. Where temperatures exceed 550 F, a combination insulation was used consisting of an inner layer of diatomaceous silica and an outer layer of 85 percent Magnesia.

This double layer construction offers two primary advantages. First, it utilizes both the high heat resistance of the diatomaceous silica as well as the low thermal conductivity of the 85 percent Magnesia. Second, it permits staggering of the joints in the successive layers, thus preventing direct openings to atmosphere in the insulation which might otherwise be caused by high temperature expansion of the equipment.

Insulation Techniques

Before any of the boiler surfaces were insulated, they were thoroughly wire-brushed to remove all dirt, scale, or construction debris, and the unit was pressure-tested. This same procedure was used for the boiler auxiliaries. Table I lists these various auxiliary units, their operating temperatures, and the thickness of diatomaceous silica and/or 85 percent Magnesia which was applied.

The various steps followed in insulating one of the closed feedwater heaters — operating temperature 850 F — are typical of the work done throughout the plant. After the heater was cleaned and pressure-tested, 2-in. blocks of diatomaceous silica were applied to the heater shell and strapped with circumferential steel bands. Blocks were closely butted, and where necessary joints were pointed up with insulating cement. A 2-in. layer of 85 percent Magnesia followed, fastened to the vessel with 1/8-in. steel cables and annealed iron wire lacing. At the dished heads of the heater the blocks were scored

TABLE 2 — DETAILS OF INSULATION ON PIPING

Pipe diameter in.	Operating temperature, deg F: 151-300	301-400	401-550	551-700		701-800		801-900		901-1000		1001-1100	
	Thickness of insulation, in.: M*	M	M	ds**	M	ds	M	ds	M	ds	M	ds	M
under 2	1	1½	2	2	0	2	0	2	0	2	0	2	0
2	1	1½	2	1½	1½	1½	1½	1½	1½	1½	1½	2	1½
2½	1	1½	2	1½	1½	1½	1½	1½	1½	2	1½	2	2
3	1	1½	2	1½	1½	1½	1½	1½	1½	2	1½	2	1½
4	1	1½	2	1½	1½	1½	1½	1½	1½	2	1½	2	2
6	1	2	2½	1½	1½	1½	2	2	2	2½	2	3	2
8	1½	2	2½	1½	1½	1½	2	2	2	2½	2	3	2
10	1½	2	2½	1½	1½	1½	2	2	2	2½	2	3	2
12	1½	2	2½	1½	2	1½	2½	2	2	2½	2	3	2
over 12	1½	2	2½	1½	2	1½	2½	2	2	2½	2	3	2

*85 percent Magnesia **Diatomaceous silica

and shaped to fit, with steel cables crisscrossed and laced over the insulation to secure it in place.

Hexagonal 2-in. wire mesh was then stretched taut over-all. This mesh lends additional support to the blocks, and also serves as a base for a ¼-in. coat of asbestos insulating cement followed by ¼-in. of asbestos hard finish cement. Protective covering of the insulation varied with the nature of the equipment. Special steps were taken to permit heater maintenance without disturbing the insulation materials. Both the shell section and the water box head are removable. Serial and insurance numbers were left uninsulated.

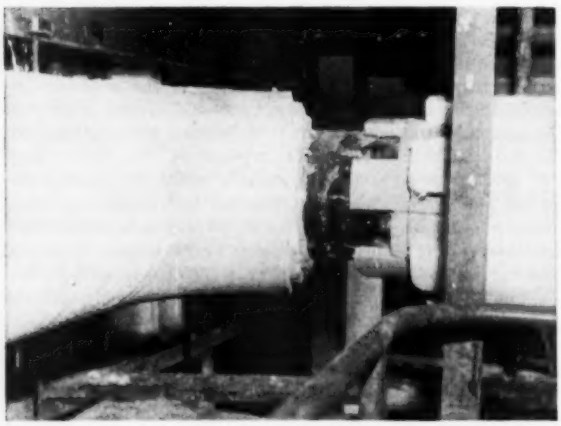
As in the case of the equipment, piping was cleaned and pressure-tested before any insulation was applied. All hot piping with operating temperatures up to 550 F has a single layer of 85 percent Magnesia insulation. Piping with temperatures exceeding this limit is covered with double layer insulation consisting of an inner layer of diatomaceous silica and an outer layer of 85 percent Magnesia. Applied thicknesses are listed in Table 2.

Insulation was secured to the piping with 16-gage annealed iron wire, using at least 4 loops per 3-ft section. Where necessary the closely butted joints were pointed up with insulating cement. In some instances the insulation was not applied to piping, flanges, or miscellaneous facilities until the plant was in service. This procedure permits tightening of flange bolts and adjusting of equipment when it is heat-expanded.

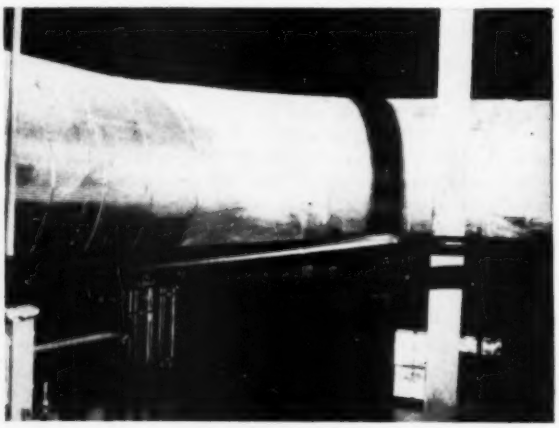
Aluminum Jackets

The finish applied to all hot pipes (with the exception of low pressure piping in the office section) and some equipment insulation in the plant, constitutes another engineering innovation. Instead of the canvas generally used, a special corrugated aluminum jacket was applied over the insulation. Pieces of this jacketing material were cut to the outer circumference of the pipe insulation plus a suitable allowance for overlap. They were fastened around the insulated piping by means of soft aluminum bands having special locking devices to assure a permanent application.

Valves and fittings in 3-in. and larger piping were insulated with 85 percent Magnesia block, wired on, then finished with asbestos insulating and hard finish cement on hexagonal wire mesh. Smaller-sized valves and fittings were insulated with the same cement to a thickness equal to that of the adjacent pipe insulation. Where insulation was applied to flanged valves, fittings, drains, or companion flanges, it was beveled to permit ready access to flange bolts without damage to the insulation. Flange coverings of the permanent type were used but applied in such manner that their removal would not harm the adjacent pipe insulation.



Partly insulated main illustrates application technique.



Same line, completely covered, is neat; easy to maintain.

Mass Production Methods

Make Lighting Maintenance Easy

MORGAN CHRISTENSEN
Lamp Division
General Electric Company

MASS PRODUCTION techniques are becoming more widely used every day in industrial lighting maintenance. Industry has recognized the need for good lighting. Illumination levels are constantly being increased. To get these higher levels of illumination, increasing numbers of lamps and lighting fixtures are being used. Row on row of fluorescent lamps are used in many factories today. Such lighting systems are well suited to assembly line techniques for cleaning fixtures, repainting surfaces, and replacing old lamps.

Many new devices have been introduced to make lighting maintenance easier. In an effort to reduce maintenance, lamp manufacturers have brought out reflector type lamps with the reflecting surface on the inside of the glass bulb. Fixture manufacturers now make most reflectors with ventilation holes in the top; these holes allow dust and dirt to pass through the fixture. Otherwise, soot would deposit on lamps and reflecting surfaces from convection currents from the hot lamps.

Using Trucks

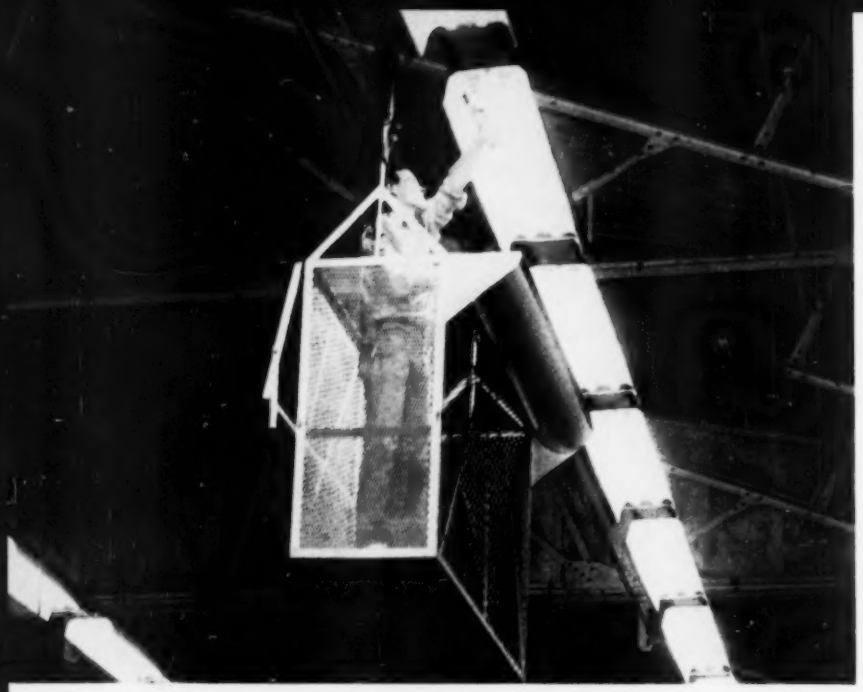
Industrial trucks are commonly used for transportation of materials about the plant; these same trucks can be modified for lighting maintenance. A boom truck is used in a Peoria, Illinois plant; it has a self-powered elevating platform which enables the workers to clean fixtures and change lamps quickly and efficiently. Two men, using this truck full-time, completely maintain the 16,254 lamp installation.

A platform lift truck has been specifically designed for lighting maintenance. This 1-man truck can be used to service lighting fixtures that are mounted at heights of 10 to 20 feet. The platform can be raised or lowered and moved horizontally by controls on the platform. The operator can drive the truck while standing on the platform after it is lowered. Water for cleaning fixtures is stored in a tank on the rear of the truck; the water tank also serves as a counterweight. Clean water is pumped into a fixture-washing tank on the platform and dirty water drains back into another compartment. Adjustable drip cloths are attached to the sides of the platform. Equipment such as this can substantially reduce lighting maintenance cost where large numbers of fixtures are involved.

Scaffolds

Many types of scaffold are used for lighting maintenance. They are portable, lightweight, sturdy, safe to use, easy to assemble, and adjustable. Scaffolds are usually preferred over ladders because they provide a safe, firm platform on which to work, and they permit greater range of work area when once set in place.

The use of a relamping bridge enables workers to relamp and clean two or more rows of fixtures simultaneously. The legs are spaced as far apart as possible to fit aisles and to allow the bridge to clear floor-level obstructions such as machines, desks, and work benches. Storage spaces on the working level for lamps, starters,



This traveling cage is permanently installed. It is suspended from a cable strung under the roof trusses; the cage is pulled back and forth by the men.

and cleaning material can increase the usefulness of a scaffold.

Many industrial areas have cranes already installed which can be used to maintain the lighting system. When a crane is used for lighting maintenance, this work must be coordinated with the crane operator's regular work to minimize production interruptions. Lighting systems can often be installed in such a manner that they can be maintained from a production crane.

Fluorescent lamps are being used more extensively at higher mounting heights because a well-maintained fluorescent system often provides light at a lower over-all cost than either a mercury or an incandescent system. A fluorescent system, however, requires more lamps for a given lighting level. Therefore, provisions for maintenance are all the more important when a fluorescent system is installed.

One method of providing access to the lamps is to build a catwalk along the rows of fixtures. Another method used in a large aircraft plant for maintenance of a fluorescent lighting system uses a traveling cage hung from a cable. The cableway is suspended 30 feet in the air, along the side of each row of fixtures. The cages are easily pulled back and forth by the operator. They are entered from either end of the 450-foot building and are designed to hold two 200-pound men and 150 pounds of lamps, accessories, and cleaning equipment. The entire cost of the cableway system was made up by the labor costs saved in one plant-wide relamping and cleaning operation. The combination of mass relamping and this maintenance cage has cut lighting maintenance costs 75 percent.

A ladder is a simple and inexpensive maintenance device. For individual lamp replacement, it is quite often the easiest solution. To make ladders more useful some modifications can be made, such as combination ladders and storage carts, or ladders with built-on extension arms to match existing elements in the building structures.

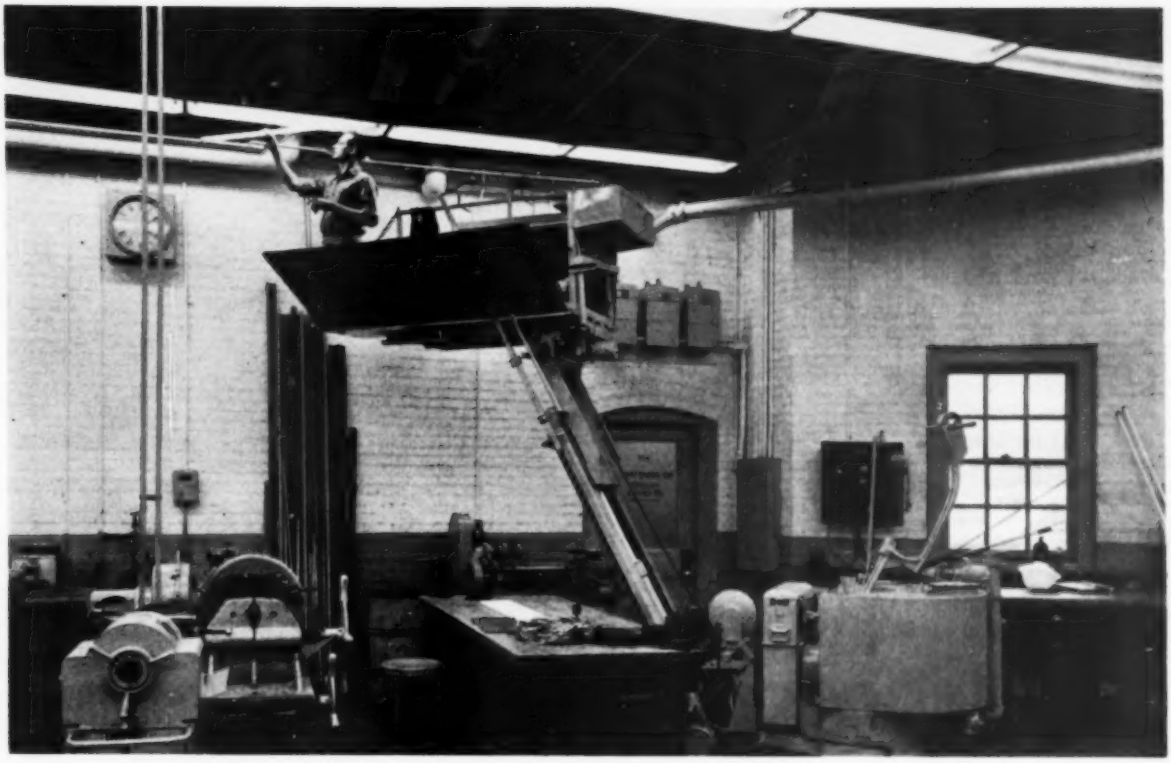
Operating Techniques

Cleaning fluorescent lighting fixtures is easily adapted to mass production techniques. One man on a raised platform or scaffold disassembles fixtures, cleans fixture chassis, cleans lamps, or installs new lamps under one mass relamping system. A man on the floor cleans louvers and side panels, moves the platform or scaffold as required, and provides

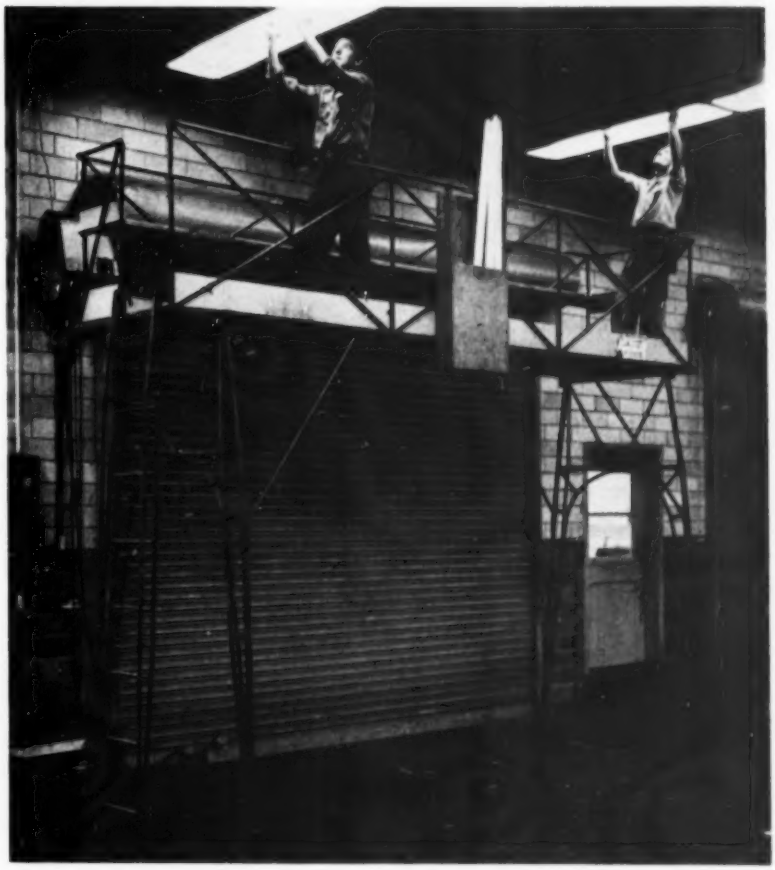
Upright Scaffolds

Scaffolds provide sturdy working areas as well as great mobility.

Lighting maintenance in office areas of large plants can be done with mass production methods too; crew uses rolling wash cart and good work pattern.



Shop in plant accommodates this special truck with water tank in rear.

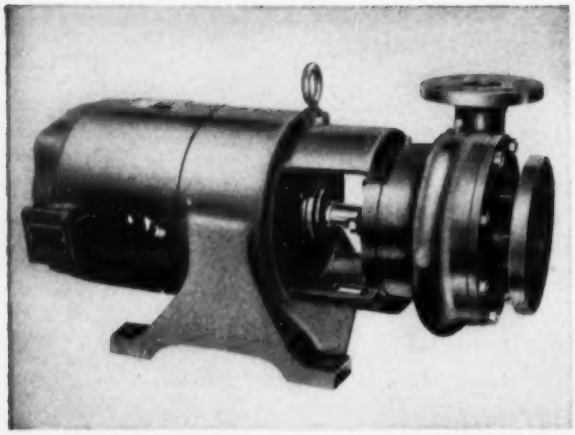


Aisle-width scaffolds give maximum working area after set in place.

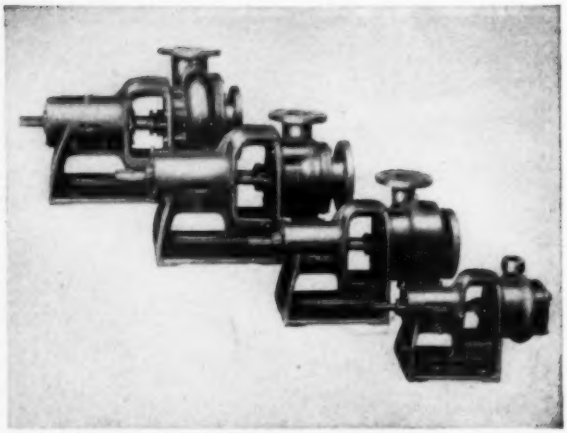
materials to the man working on the platform.

Fixture-washing tanks are of special interest. One arrangement has a wash compartment and a rinse compartment at the rear. Once reflectors and louvers are washed and rinsed, they are hung on a drain rack located above the rinse tank. The washing tank contains two electric immersion heaters to keep the detergent wash water warm. The tank cart has a 50-foot connecting cord which can be plugged into any standard outlet; a 50-foot grounding cord is provided for safety. The tank cart can be moved easily from location to location on its large locking castors. A large shelf holds cleaning materials.

With the increasing use of specialized maintenance devices, mass relamping, or group replacement as it is often called, is becoming more and more practical. Lamp quality is better than ever; lamp life has been extended and the number of early burnouts has been decreased. Both of these factors make mass relamping attractive.

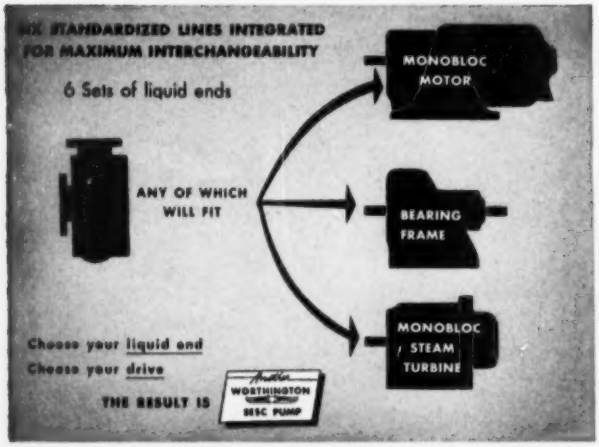


WITH BUILT-IN MOTOR—Well known throughout industry is this compact streamlined Worthington Monobloc centrifugal pump. Worthington SESC standardization makes it possible to interchange any of six sets of liquid ends to the motor housing.



FOR ANY CONVENIENT DRIVE—Frame-mounted units are available in four frame sizes. Like the Monoblocs, they use the same six sets of liquid ends and either conventional packing or a standardized mechanical seal that is readily changed in the field if necessary.

Why Worthington's SESC* pump line means greater availability, broader selection, easier servicing



STANDARDIZATION of *parts*, *mountings*, *materials* and *dimensions* virtually eliminates the necessity of slow and expensive custom manufacture to meet special pumping requirements. From 650 parts within its six standardized sets of liquid ends, Worthington can assemble 60,000 *different* standard pumps! C.3.1

Greater availability because the new Worthington pump line will handle more requirements with a *standard*, readily obtainable unit.

Broader selection because of the complete range of ratings and special design features in the 60,000 different SESC pumps.

Easier servicing because standardized parts mean lower parts-inventory requirements.

This sums up the advantages you can expect when you use Worthington standardized centrifugal pumps. The SESC line is Worthington's latest move towards assuring you the *right* pump for the job.

For more information, contact your local Worthington distributor or write for Bulletin W300 B-4 to Worthington Corporation, Centrifugal Pump Division, Harrison, New Jersey.

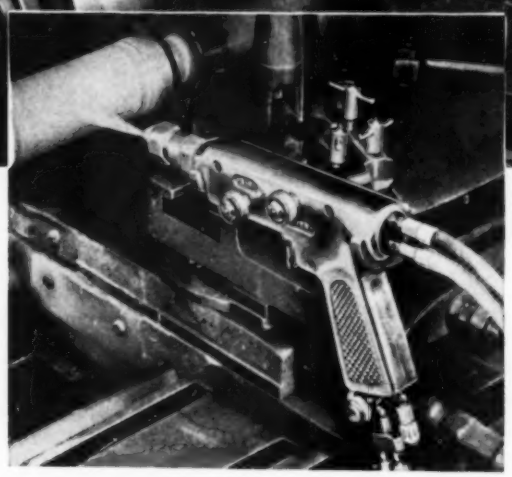
**Standardized End Suction Centrifugal*

The World's Broadest Line Assures You The Right Pump For Every Job

WORTHINGTON
Centrifugal Pumps

Circle 554 on Reply Card for more data

Fusing the No. 6 Colmonoy alloy to the base metal by heating the revolving part with an oxy-acetylene flame is part of the sprayweld process that is being successfully used to renew and to prolong the life of a pump plunger.



A Spraywelder pistol is mounted on the engine lathe tool post and sprays alloy as it moves back and forth.

Longer Life For Pump Plungers

WEAR LIFE of a pump plunger has been increased more than seven times by applying a 0.025 inch thick fusion-bonded, nickel-base hard facing overlay with the Colmonoy Sprayweld process.

The pump handles dirt and grit-laden water in an Alabama steel company power plant and is subject to severe wear conditions. Hard chromium plated plungers last only 30 days in this application. In comparison, plungers coated with Colmonoy No. 6 nickel-chromium-boron alloy have lasted more than 7 months.

To apply the fused hard coating, the plunger is chucked in an engine lathe and turned to the desired dimension. The outside diameter is then given a rough threaded surface of about 80 threads per inch. This surface supports the mechanical bond between the base carbon metal and the No. 6 alloy to be sprayed on.

A Spraywelder pistol is mounted in the engine lathe tool post. It is connected to a wall mounted control unit that has a hopper for the powdered hard-facing material. The pistol is moved back and forth, parallel to the work, while the alloy is sprayed on the threaded surface as the plunger is rotated in the lathe. The overlay thickness is allowed to build up to leave sufficient stock for finish grinding the surface.

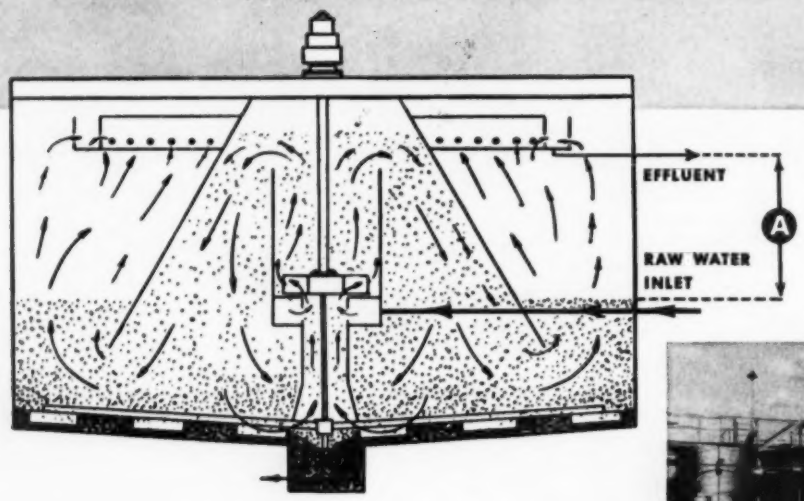
The sprayed-on alloy overlay is fused to the base metal by heating the surface with an oxy-acetylene torch. The heat helps to form a molecular bond between the coating and the base. It also leaves the surface of the coating in a non-porous condition for better wear.

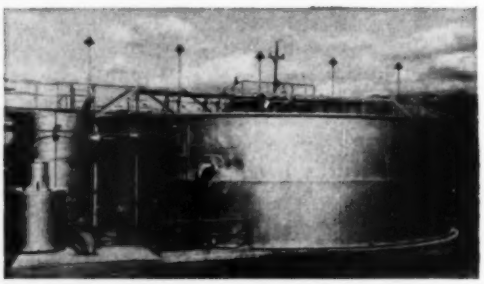
In the final step, the outside diameter of the plunger is finish-ground on a conventional grinding machine to the required size.

The Colmonoy No. 6 alloy has a 56-61 Rockwell "C" hardness. It has excellent abrasion, corrosion, and galling resistance. Two other nickel base alloys, Nos. 4 and 5, are also available in powder form for application by the same process to steel, stainless steel, and some types of cast iron and copper alloy parts.

WHY ***THIS*** WATER CLARIFIER GIVES YOU

Constant Clarity at Variable Loads





One proof of sound design is the ability to take in stride wide fluctuations in load and still produce uniformly low turbidity water. The Graver Reactivator, which has this built-in feature, was designed with this requirement in mind.

Note the diagram above and see the height "A" provided between the sludge bed level and the effluent collector at the top of the tank. This depth of clarified water is your assurance of protection against carryover during sudden load increases —constant effluent clarity—a dependable water supply.

Recently, Graver test engineers subjected a large Reactivator at an eastern paper plant to a 70% load increase within a 2-minute period. Result—the effluent turbidity remained unchanged at 5 ppm—well below the customary guarantee when operating at normal load fluctuation.

Other Exclusive Graver Reactivator Features

1. Full bottom area for solids concentration and collection.
2. Separately driven sludge scraper and blades.
3. Positive and intimate contact of incoming water with sludge by gentle recirculation with a variable speed impeller.

•

For best results in solving your water treatment problems, get the benefit of Graver's 40 years of specialized experience, proven designs and unequalled facilities.

GRAVER **Reactivators**

EQUIPMENT FOR ALL WATER AND WASTE TREATMENT PROCESSES

GRAVER WATER CONDITIONING CO.

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In Canada: The Bird-Archer Co., Ltd., Cobourg, Ontario

In Mexico: Proveedores Tecnicos, S.A., Pueblo 259, Mexico 7, D. F. GW479

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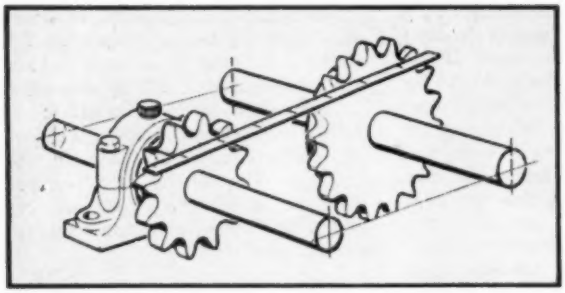
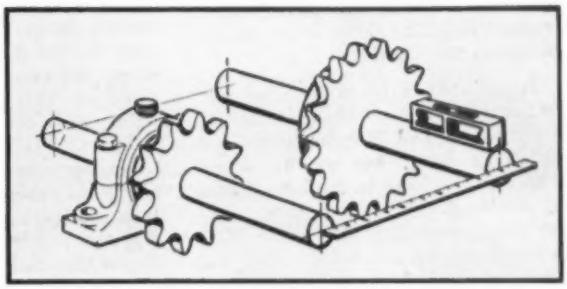


The sprocket can be accurately aligned by checking with a straight edge along the finished sprocket side.



A spirit level is used to insure shafts being horizontal while the distance between shafts is held equal.

Better Service From Roller Chains

INSTALLATION

ROLLER CHAIN is less difficult to install than many other forms of power transmission. However, care and precision during installation will more than repay the time involved.

Shaft Alignment

Shafts must be parallel. The use of a spirit level is recommended to make sure shafts are horizontal; then, if the distances between the shafts are equal on both sides of the drive, the shafts are parallel. Shafts, bearings, and supporting structure should be stable enough to maintain this alignment in operation.

Sprocket Location

Locate each sprocket as close as possible to a bearing support.

Sprocket Alignment

Sprockets must be aligned accurately. This can best be accomplished by checking with a straight edge along the finished sides of the sprockets as shown.

Chain Tension

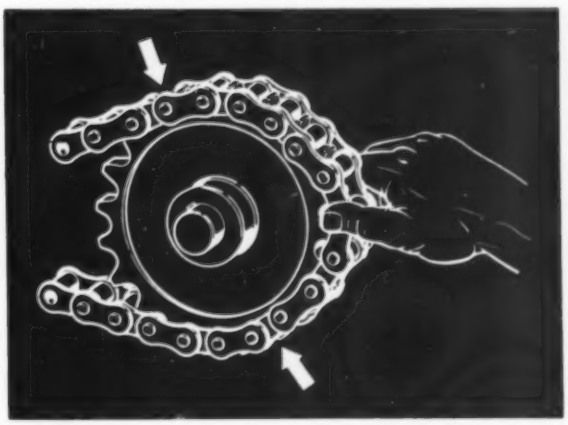
Chain should be installed fairly tight with only a small amount of slack. In the case of vertical drives the chain should be kept snug. New chains will loosen up slightly as the joints seat themselves, causing initial elongation which is many times greater than the elongation during the balance of the chain life. After the first several weeks of operation, it is advisable to adjust the centers, particularly on long center drives. After this initial elongation, with proper care and lubrication, roller chains will give long service.

Center Distance

It is desirable to provide some means of adjusting the center distance between sprockets. This is particularly true with drives of long center distance. When the centers are fixed it is advisable to use an idler sprocket to provide the proper original chain tension, and also to compensate for natural chain wear.

LUBRICATION

Lubrication of roller chains is essential for effectively minimizing metal-to-metal bearing contact of pin-cushion joints of the chain. Oil should be applied to outside plate and inside plate edges, since access to pin-bushing areas is possible only through clearances between the out-



Lifting the chain from the large sprocket, while still in mesh at the indicated points, checks excess clearance.

side plates and the inside plates. Oil applied on the center line of rollers cannot reach pin-bushing joints and, therefore, cannot retard chain wear.

A good grade of mineral oil, without additives, of medium or light consistency, free flowing at the prevailing temperature, should be used.

Drives should be protected against dirt and moisture. The method of lubrication is governed by the speed of the chain and the amount of power transmitted. The three types of lubrication are listed as:

Type 1—Drip (4 to 10 drops per minute), shallow bath, or manual with oil applied frequently with a brush or spout can to the upper edges of all plates in the lower span of chain. A circulating pump may be required when the transmitted horsepower is substantial and the center distance is short. Usually used for chain speeds up to 600 fpm.

Type 2—Rapid drip (20 drops per minute minimum) or continuous with shallow bath, disc, or slinger. A circulating pump may be required when the transmitted horsepower is substantial and the center distance is short. Usually used for chain speeds of 600 to 1500 fpm.

Type 3—Continuous, with disc, slinger or circulating pump—usually used for chain speeds over 1500 fpm.

Heavy oils and greases are not recommended for lubrication of roller chains except under unusual conditions of service because they are generally too viscous to enter and fill the small clearances between the chain parts and linkages.

Evidence of good lubrication is easy to locate by removing the connecting link and examining the lubricant and the pins. Good lubrication is indicated by black lubricant in the chain joints and bright, polished surfaces of pins and bushings after the lubricant is wiped off. Poor lubrication is indicated by a red or dark brown appearance of these parts or by a roughened and scored finish or surface.

For maximum service, chains should be periodically cleaned and re-lubricated, particularly those exposed to grit or dust. Thorough scrubbing in kerosene or gasoline and then rinsing in clean kerosene or gasoline, followed by a short period of draining, will clean the chains adequately. Re-lubricate by dipping in medium or light lubricant.

MAINTENANCE

As in the case of any precision-built mechanism, proper maintenance contributes toward long, satisfactory service life of the chain.

Every chain drive should be checked periodically for alignment. Misalignment is conclusively indicated when the sides of sprocket teeth or inside surfaces of the roller link plates show wear. Immediate steps should be taken to re-align the drive when these defects are evident.

Excessive Slack

Chain should be checked for excessive slack. If the chain is running close to the tips of the teeth of the larger sprocket, the chain should be replaced. This can be checked visually while the drive is running or by lifting the chain away from the large sprocket, making sure the chain is in mesh with the sprocket teeth as indicated by arrows in the drawing. Excess clearance is evidence that the chain has elongated in pitch, and no amount of tension adjustment will keep it properly meshed with the sprocket teeth. Continued operation will quickly destroy the sprocket teeth which otherwise may be perfectly good.

Do not install a new chain on sprockets that are badly worn. Worn sprockets should be replaced to insure proper chain fit, thus eliminating the possibility of premature wear of the replacement chain.

New drives should be frequently inspected for any possible interference with the chain. Naturally, if a chain is rubbing or striking against any obstruction it will be damaged.

Packing of foreign material between the sprocket teeth will occasionally cause the chain to ride high on the teeth, exert undue stresses, accelerate wear in the chain, and cause abnormal wear of the sprocket teeth.

Based on a publication of the Dodge Manufacturing Corporation.

CALCULATIONS

For Chain Length

To find the chain length in pitches use the formula below. If the result includes a fractional part of a pitch, it will be necessary to select a whole number of pitches. An odd number of pitches requires the use of an offset link which is not generally desirable. To obtain the chain length in inches multiply the number of pitches by the pitch of the chain.

$$L = \frac{2c}{P} + \frac{T+t}{2} + \frac{KP}{C}$$

Where L = Length of chain in pitches
C = Center distance in inches
P = Pitch of chain in inches
T = Number of teeth in large sprocket
t = Number of teeth in small sprocket
K = Factor for T — t from table

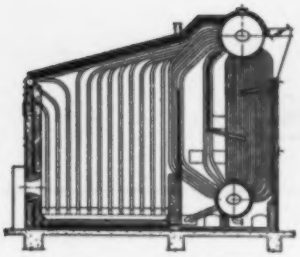
For Center Distance

To find the center distance for a snug chain having minimum initial slack use the formula

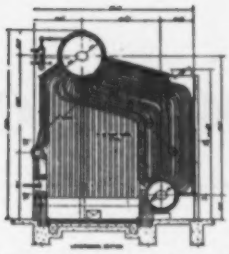
$$C = \frac{L - \frac{T+t}{2} + \sqrt{\left(L - \frac{T+t}{2}\right)^2 - M}}{4} \times P$$

Where C = Center distance in inches
L = Length of chain in pitches
T = Number of teeth in large sprocket
t = Number of teeth in small sprocket
M = Factor for T — t from table
P = Pitch of chain in inches

T—t	M	K	T—t	M	K	T—t	M	K	T—t	M	K	T—t	M	K
1	0	0	21	89	11	41	341	43	61	754	94	81	1330	166
2	1	0	22	98	12	42	358	45	62	779	97	82	1363	170
3	2	0	23	107	13	43	375	47	63	805	101	83	1397	175
4	3	0	24	117	15	44	393	49	64	830	104	84	1431	179
5	5	1	25	127	16	45	411	51	65	857	107	85	1465	183
6	7	1	26	137	17	46	429	54	66	883	110	86	1500	187
7	10	1	27	148	18	47	448	56	67	910	114	87	1535	192
8	13	2	28	159	20	48	467	58	68	938	117	88	1570	196
9	16	2	29	171	21	49	487	61	69	965	121	89	1606	201
10	20	3	30	182	23	50	507	63	70	994	124	90	1642	205
11	25	3	31	195	24	51	527	66	71	1022	128	91	1679	210
12	29	4	32	208	26	52	548	68	72	1051	131	92	1716	214
13	34	4	33	221	28	53	570	71	73	1080	135	93	1754	219
14	40	5	34	234	29	54	591	74	74	1110	139	94	1792	224
15	46	6	35	248	31	55	613	77	75	1141	142	95	1830	229
16	52	6	36	263	33	56	636	79	76	1171	146	96	1869	233
17	59	7	37	278	35	57	659	82	77	1202	150	97	1908	238
18	66	8	38	293	37	58	682	85	78	1234	154	98	1947	243
19	73	9	39	308	39	59	706	88	79	1265	158	99	1987	248
20	81	10	40	324	41	60	730	91	80	1298	162	100	2028	253



2 Drum Water Tube Boiler



Type-S 2 Drum Boiler Series 51

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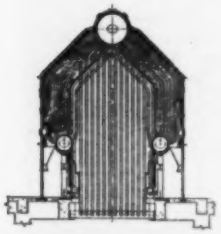
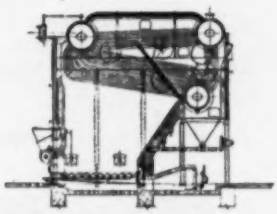
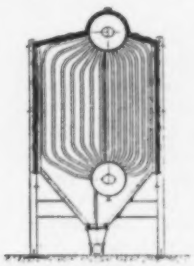


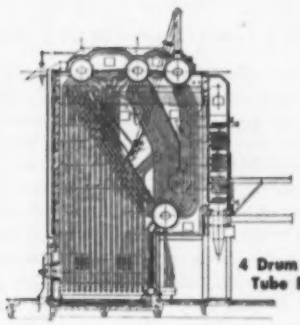
"A" Type Water Tube Boiler



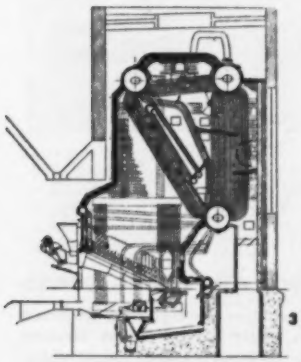
3 Drum Low Head Water Tube Boiler



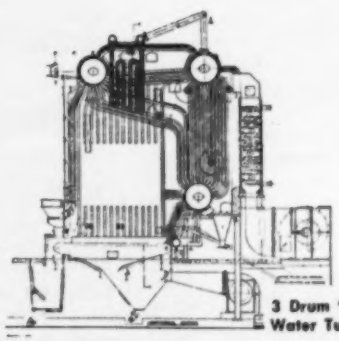
Wickes 2 Drum Waste Heat Installation



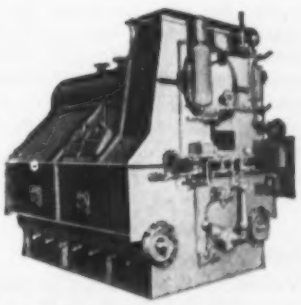
4 Drum Water Tube Boiler



3 Drum Water Tube Boiler



3 Drum "B" Type Water Tube Boiler



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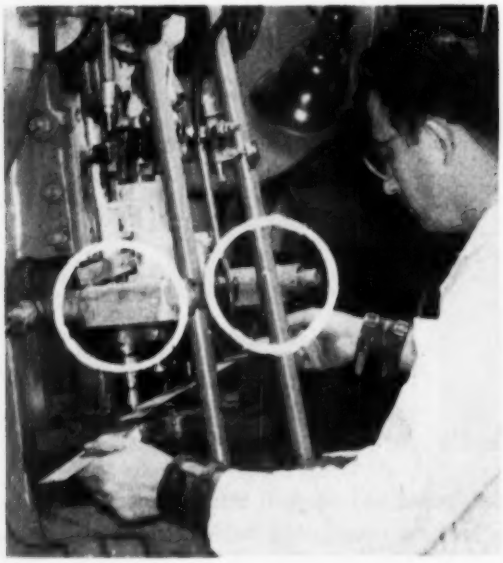
spot news

. . . what's happening in U. S. industrial plants



"Atomic" Device Used as Safety Control on Punch Press

First of its kind for heavy machinery, an "atomic" device to protect the hands of punch press operators is said to open a new field of industrial safety.

Operators of the accident-proof punch press wear wristbands containing radio-active crystals. Three Geiger tubes (circled in photograph) enclose the punching area—one at the front and one on each side of the zone where injuries can occur. If hands stray into danger, the tubes pick up radiation from the wristbands and instantly halt the machine. The device is so sensitive that it can stop the punch in mid-stroke.

As a further safety measure, the punch press will not run unless the operator is equipped with the wristbands. An impulse from the radio-active crystals is required to trigger the machine for use. Within 15 seconds after the wristbands are withdrawn, the machine automatically shuts off. The bands are said to be harmless to wearers.

Hazatrol Inc. of Berkeley, California, designed the safety device which is in use at the San Francisco maintenance base of United Air Lines.

Dust Sampling Possible Without Interrupting Operation

Mine Safety Appliances Co., Pittsburgh, has been named exclusive distributor in the United States for a line of dust-measuring equipment manufactured by C. F. Casella & Co. Ltd., of London, England.

The units now being introduced for American users include the Casade Impactor, for discriminatory collection of air-borne dusts by particle size; Settlement Dust Counter, for accurate collection of dust particles or air-borne bacteria; Thermal Precipitator, for sampling a wide variety of smoke, fumes, and dust, organic or inorganic; and the Jet Dust Counter, for rapid or "snap" samplings without interruption of operations.

Operating on a principle involving low jet speeds in collecting either solid or liquid particles, the Cascade Impactor is said to have an efficiency of collection approaching 100 percent for particles in a size range from 0.7 up to 50 microns, and is useful in sampling even larger particles, up to 200 microns.

The accuracy of the Settlement Dust Counter is achieved by enclosing a definite volume of air and by eliminating such disturbing factors as terminal velocity of particles, turbulance, air movement and temperature, and humidity.

The Thermal Precipitator is described as well-suited for highly accurate sampling of all kinds of airborne particles, but particularly dust clouds, organic or inorganic. The dust sample obtained is examined under a high-power, high-resolution microscope.

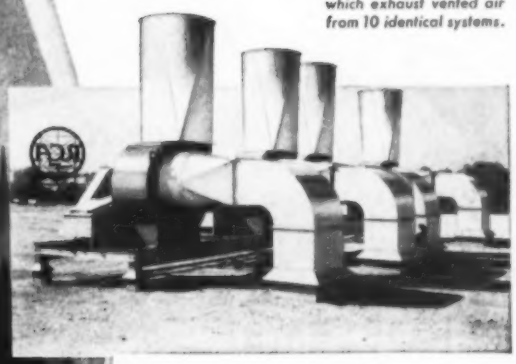
Rapid sampling made possible by use of the Jet Dust Counter is said to be especially valuable for estimating the concentration of dusts at a variety of points in factory, mine, or other location, and in dust control work where a large number of samples may be taken over a period of time for comparison.

Detailed information on these instruments is available from Dept. IP, Mine Safety Appliances Co., Braddock, Thomas, and Meade Sts., Pittsburgh 8.

ELECTRIC SNOW MELTERS KEEP RAIL TRAFFIC MOVING

Snow and ice have no effect on the Pennsylvania Railroad track switches equipped with Westinghouse Corox heating element, snow-melters. Controlled from a signal tower, these electric heaters are said to assure summer performance of track switches in the severest winters, require little maintenance, are completely waterproof, and can be left installed all year—ready for a quick change in the weather.

how to PICK UP 2,900,000 BTU without "wiggling" the flame



One of a number of batteries of roof-top fans which exhaust vented air from 10 identical systems.

. . . solved by a KIRK AND BLUM ventilation system!

Above—Battery of RCA Sealex machines. Heat from glass sealing and evacuating operations on electron tubes is collected by aluminum hoods and duct-work.

At right—Radio Tube Stem & Bulb Tubulator machines. Heat from glass working operations is picked up and vented. Replacement air is furnished by Kirk & Blum systems.

Heat can be a headache in any plant. Here, in a midwestern tube plant of RCA Victor Division, Radio Corporation of America, glass sealing and forming operations require plenty of heat of all kinds—induced, radiated and reflected. For the comfort and safety of workers, this heat must be removed but without disturbing the play of gas flames on delicate parts.

KIRK & BLUM engineers achieved a fine balance, removing 2,900,000 BTU hourly and without distorting the delicate flames.

Whatever your ventilation problem... heat, dust or fumes... the best, lowest-cost solution involves more than a fan, motor and some lengths of duct. Put it up to experts... **The Kirk & Blum Mfg. Co., 3174 Forrer Ave., Cincinnati 9, Ohio.**

KIRK AND BLUM
VENTILATION SYSTEMS

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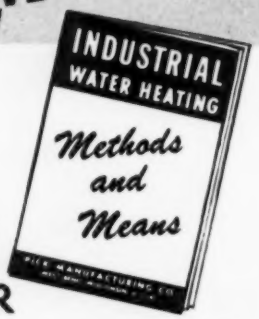

Booklet with the ANSWERS TO YOUR HOT WATER PROBLEMS! NO OBLIGATION

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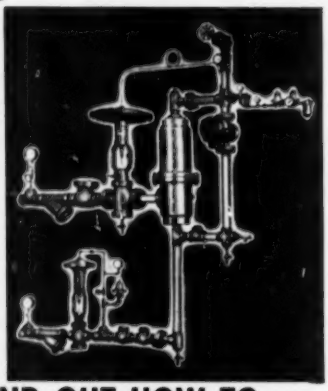
Pick INSTANTANEOUS WATER HEATERS

Industries all over America are finding Pick Heaters the money-saving answer to their hot water problems. Water is heated INSTANTLY by steam injection to exact temperature desired and in volume needed. Easy to install — no storage tanks required.



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Without obligation send your booklet on how Pick Heaters cut costs of hot water used for purpose checked.

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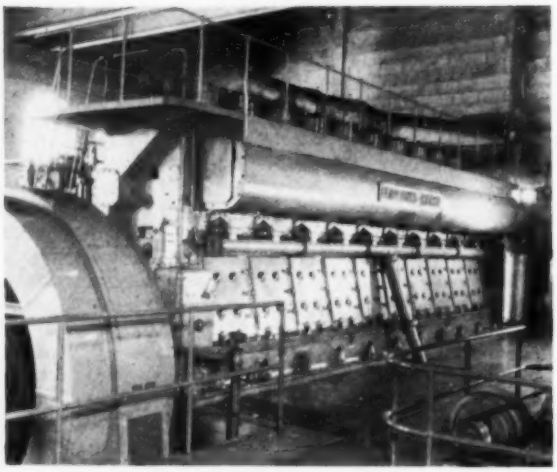
spot news

— Starts on page 102



Heavy Fuel Oil Reduces Cost

Savings of more than $50,000 a year have been realized at the Murray, Utah, Municipal Power Plant by the use of heavy duty fuel oil and an improvement program including installation of a 3500 hp diesel. In its first full year of operation, the Fairbanks-Morse diesel produced an average of 13 kw hrs per gal as compared to a plant average of 12.14 kw hrs per gal during the five months preceeding its installation.

All four diesels now in operation are using low cost No. 5 fuel oil—5.83c per gal as against 10.8c per gal for No. 2 oil. The fuel as supplied has a heat value of 147,300 Btu per gal. Use of a heavy-duty detergent lubricating oil in the crankcase and cylinder lubricators protects the engines from wear due to high sulfur content, 1.2%. During the first year's operation, some difficulty was experienced with injection nozzle failure on the older engines but slight alteration of the oil composition by the supplier, Standard Oil, and better filtering at the plant has brought nozzle replacements down to a minimum.

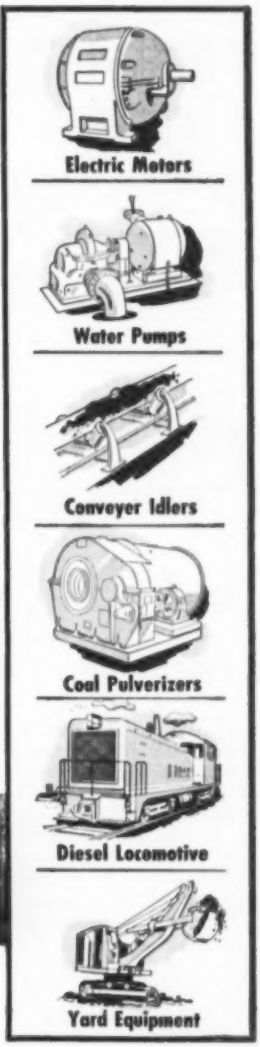
The town's power supply consists of the diesel-electric plant, an 800 kw load head hydro plant located in the foothills of the Wasatch mountains, and an emergency power connection with Utah Power and Light Co. During a peak demand of 4700 kw in December, 1952, the load was distributed among the units as follows: 2150 kw from the new diesel, 1450 kw from the three older engines, and 200 kw from the hydro plant.

Method Minimizes Introduction of Fresh Air in Boiler Water Samples

The problem of corrosion of steam condensate systems is due largely to the reduction of the pH of the condensate by carbon dioxide evolved in the boiler.

The paper, "Determination of Low Amounts of Carbon Dioxide in Water," by J. B. Smith, E. K. Gilbert, and M. Howie of the Permutit Co., points out that analysis of condensate and boiler feed water for total CO_2 of less

"Indianapolis Power & Light Company's large new White River plant uses Shell Alvania Grease on every one of these grease applications!"



Check the multiple qualities of this remarkable lubricant

Shell Alvania Grease is effecting important improvements in plant maintenance and purchasing practice. In plant after plant, this one grease is replacing the many special purpose greases formerly used . . . for *every grease application in the plant!*

Look at these advantages:

1. Shell Alvania Grease flows *freely* in cold temperatures, yet will not run out of bearings under excessive heat.

2. Ideal for wet, humid applications . . . it resists water emulsification.

3. Shell Alvania Grease has extremely high oxidation stability.

4. You'll find that Shell Alvania Grease extends time between greasings . . . a substantial saving in labor and grease.

5. Simple inventory . . . just the one grease to stock and apply.

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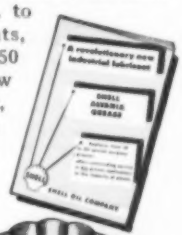
The economy of handling just one grease instead of *many* is an established fact. Write for the new booklet on Shell Alvania Grease . . . to Industrial Lubricants, Shell Oil Company, 50 West 50th Street, New York 20, N. Y.—or, 100 Bush Street, San Francisco 6, Calif.



SHELL ALVANIA GREASE

The True Multi-Purpose Industrial Grease

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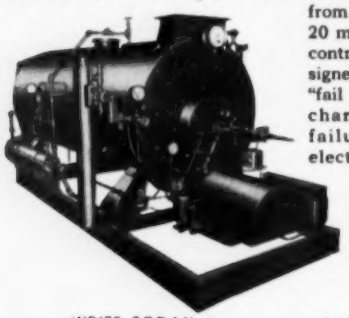
COMPACT
EFFICIENT
DEPENDABLE
FOR MODERN SCHOOL HEATING

CYCLOTHERM*
CYCLONIC COMBUSTION

COMPACT . . . No extensive stack, foundation, insulation, excavation or instrumentation is required. Cyclotherm Units are delivered complete, the Contractor sets the boiler on the spot you choose and makes five easy connections; fuel, electricity, water, steam and a simple flue to comply with local codes. The Cyclotherm is the smallest fire tube boiler available for its rated capacity, which provides the architect maximum use of space.

EFFICIENT . . . The efficiency of any boiler is determined by the rate of heat transfer from fuel to useful heat. The superior advantage of a Cyclotherm Unit is due to the increased transfer of heat by radiation of the flame, the characteristic of which is controlled by Cyclonic Combustion, a patented combustion method used in Cyclotherm Units which allows a guaranteed minimum efficiency of 80% and low fuel consumption.

DEPENDABLE . . . Cyclotherm boilers give you full power from a cold start in 15 to 20 minutes. The electronic control system is so designed that the boiler will "fail safe" in case of mechanical breakdown or failure of fuel, water or electricity. Local factory trained engineers are always ready to give you immediate service and keep your boiler running smoothly.



WRITE TODAY for your copy of "All Your Questions Are Answered by Cyclotherm" and find out why Cyclotherm Steam Generators have been proven superior in thousands of installations. Just drop a post card to Cyclotherm, Dept. 38, Oswego, New York.

*Reg. trade name

CYCLOTHERM STEAM GENERATORS
CYCLOTHERM DIVISION UNITED STATES RADIATOR CORP.—OSWEGO, NEW YORK

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spot news

— Starts on page 102

than approximately 0.5 ppm has, in the past, been accomplished by direct means, but that a newer method has been perfected to allow the determination at levels of approximately 0.1 ppm.

The system, designed to minimize the introduction of fresh air and hence CO_2, when introducing the sample, is an evolution process employing recirculated air in a closed system to strip the carbon dioxide from a boiling acidified sample. The CO_2 is absorbed in a barium hydroxide solution, which is back-titrated with standard acid. The values obtained are compared with a blank, previously boiled acidified distilled water.

Data obtained in the field on the determination of CO_2 in the effluent from a corrosion-resistant deaerating heater, treating an acid water, show a value of less than 0.1 ppm. Field tests on a demineralizing plant, employing a highly basic anion exchanger, also show a value of less than 0.1 ppm in the effluent.

High Argon Production Promised by New Plant

Argon, the "lazy" gas that has gone to work for industry, is now being commercially extracted at the Houston Oxygen Company's new million dollar plant in Houston. The gas is being produced on a large scale in connection with the liquid oxygen and nitrogen production.

To recover the 0.9 per cent argon from the atmosphere, air is rectified and broken up into its components. A giant balloon suspended from a three story ceiling stores the argon before purification.

Largest potential use for the gas is in welding stainless steel, aluminum, magnesium, titanium, copper, and

(Continued on page 130)

the pd Decantation Principle

Catches the small ones (flyash) and lets the big ones go . . .

back to the boiler for refiring

Separation of the fines from coarse high carbon flyash for refiring is at last possible in one unit, with no added pressure drop.

Prat-Daniel's Tubular Dust Collector, arranged for Decantation, permits efficient refiring of high carbon dust *without* recirculating the fines!

The P-D two-stage tubular collector is combined in *one* unit yet is no larger in area than a standard P-D Collector. In operation, it requires no additional pressure drop yet assures an extremely high efficiency in the range below 20 microns!

The Thermix Corporation—Project Engineers for Prat-Daniel—will be glad to show you how Decantation saves fuel and eliminates poor combustion resulting from total re-injection.

Ask them for full details on P-D Dust Collectors, Fan Stacks, F.D. and I.D. Fans. P-D Unit Responsibility on these components relieves you of the necessity of integrating equipment from various sources . . . helps make your operation more efficient, less costly. It will pay you to call Thermix today.

Ask for P-D Catalog 4-P201.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec, Toronto 5, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION

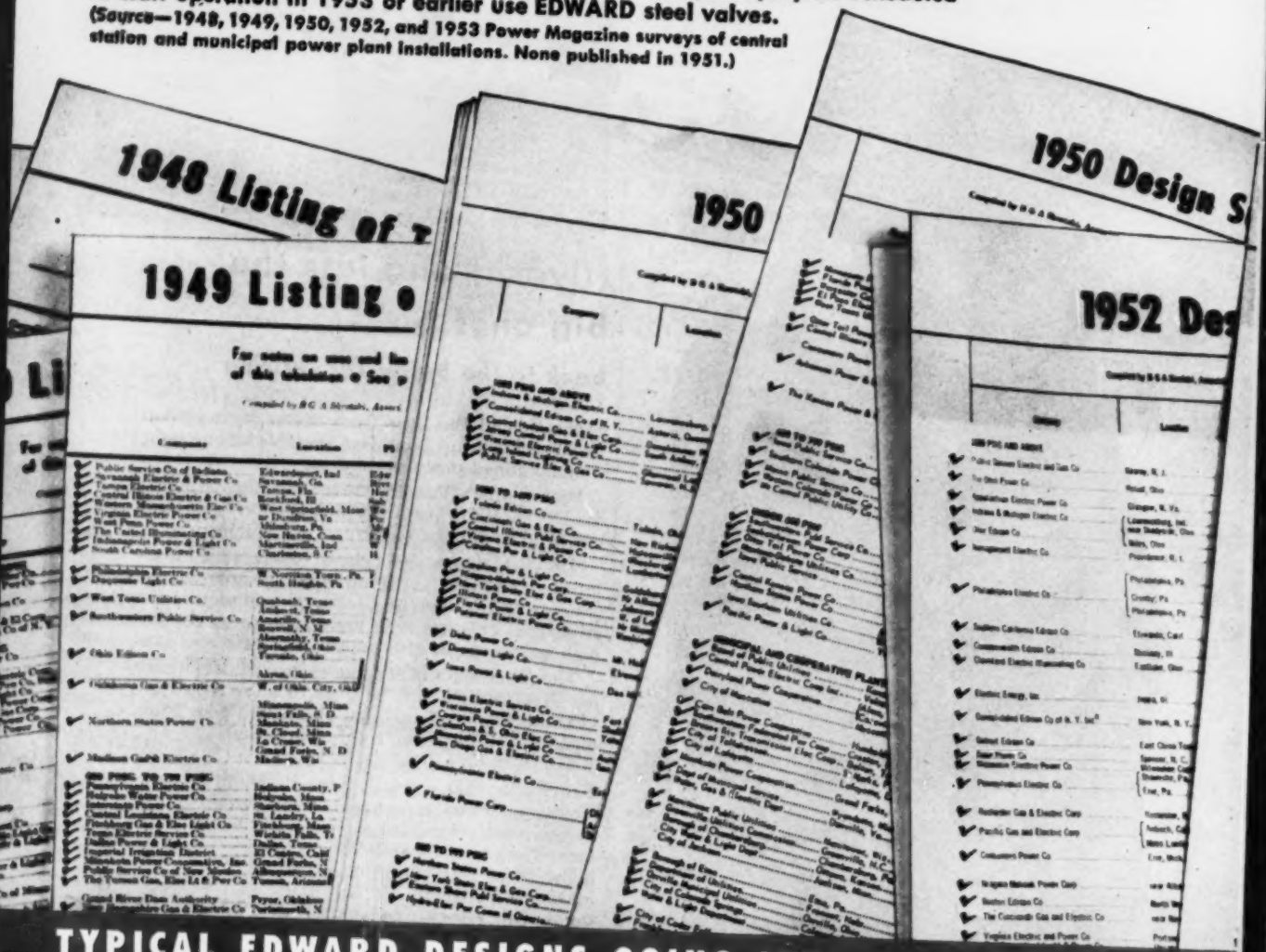
SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks.

Circle 562 on Reply Card for more data

Again it's Edward Valves in over

THE EVIDENCE: **575 out of 598 (96.15%) of new central station and municipal power plant projects scheduled to start operation in 1953 or earlier use EDWARD steel valves.**
(Source—1948, 1949, 1950, 1952, and 1953 Power Magazine surveys of central station and municipal power plant installations. None published in 1951.)

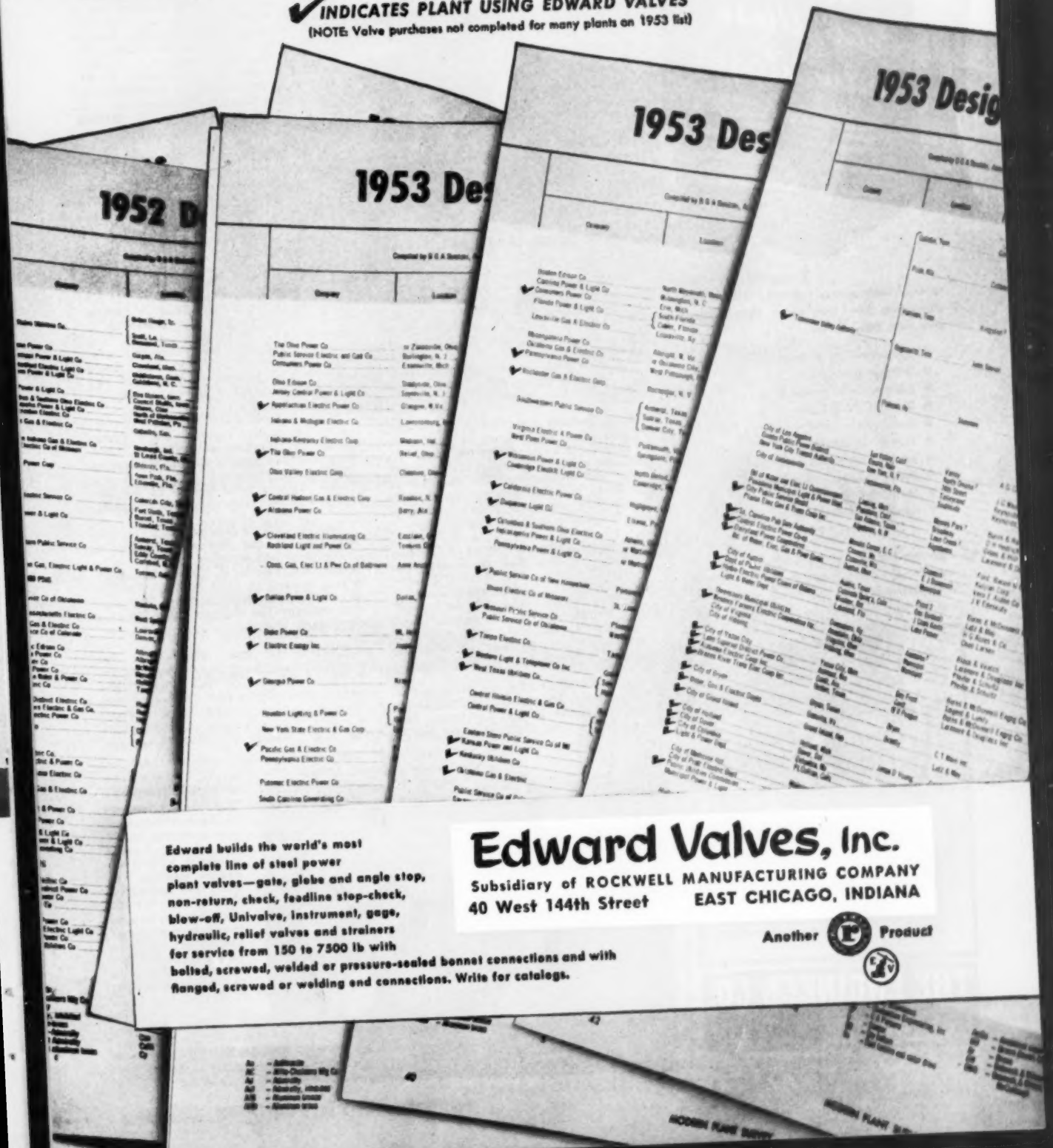


TYPICAL EDWARD DESIGNS GOING INTO NEW STATIONS

Circle 563 on Reply Card for more data

96% of new power plant projects

✔ INDICATES PLANT USING EDWARD VALVES
(NOTE: Valve purchases not completed for many plants on 1953 list)



Edward builds the world's most complete line of steel power plant valves—gate, globe and angle stop, non-return, check, feedline stop-check, blow-off, Univalve, instrument, gage, hydraulic, relief valves and strainers for service from 150 to 7500 lb with bolted, screwed, welded or pressure-sealed bonnet connections and with flanged, screwed or welding end connections. Write for catalogs.

Edward Valves, Inc.

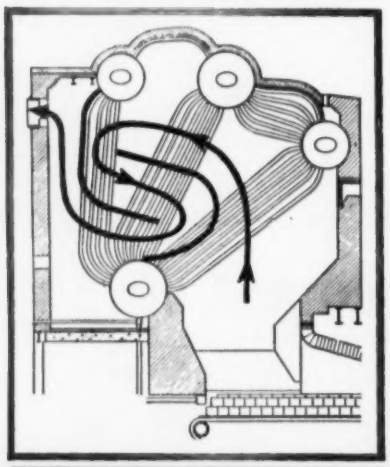
Subsidiary of ROCKWELL MANUFACTURING COMPANY
40 West 144th Street EAST CHICAGO, INDIANA

Another Product

These important fuel-saving, maintenance-reducing features are obtainable with Enco boiler baffles — and only with Enco baffles.

- **Streamlined gas flow**
- **Uniform gas flow**
- **Elimination of bottle necks**
- **Reduced draft losses**
- **Higher heat transfer**
- **Cleaner heating surfaces**
- **Less use of soot blower**
- **Special provision for expansion**
- **Easy tube replacement**
- **Adaptable to any water-tube boiler, fired by any fuel**

Each application is designed on the basis of more than a quarter century of experience in this specialized branch of power engineering. Installations are made by skilled mechan'cs.



THE ENGINEER CO.
Enco 75 West St. New York 6, N. Y.

Circle 564 on Reply Card for more data

names make news

. . . personalities from industry and power

The American Welding Society has re-elected as its President for 1953-54 **Fred L. Plummer,** director of engineering, Hammond Iron Works. It will be his second successive term. Other newly e'ected officers follow: First Vice President, **J. H. Humberstone,** v-p of Air Reduction Co., Inc.; Second Vice President, **J. J. Chyle,** director welding research, A. O. Smith Corp.; Treasurer, **R. S. Donald,** president, R. S. Donald, Inc.

F. L. Plummer

Supplementing his duties as vice president and director of **The Electric Storage Battery Co., Roland Whitehurst** is appointed general manager of the Industrial Products Div. This appointment was a final step in the complete separation of company operations into two divisions—industrial products and automotive products.

B. T. Rabuse is named to the newly-created post of director of purchases of **Gould-National Batteries, Inc. W. C. Shull** is appointed purchasing agent under the direction of the director of purchases and will confine his activity to handling purchase requirements of the company's industrial div.

Marlow Pumps merges as of December 1st with the **Bell & Gosset Co.** Under the new set-up, Marlow Pumps will be known as the Marlow Division of Bell & Gossett and will be headed by **A. S. Marlow, Jr.,** as general manager. He will also be a vice president and a member of the board of directors of Bell & Gossett.

Two old and well known firms in the water conditioning business have united: **Refinite Sales Company** has joined forces with **Elgin Softener Corp.** Products and services of both companies are now being handled by a combined sales-engineering organization known as **Elgin-Refinite, Inc.,** a newly created division of Elgin. Officers of Elgin-Refinite are **C. T. McGill,** chairman of the board; **E. W. Scarritt,** president; **C. A. Spaulding** and Dr. **George Lindig,** vice presidents; **R. W. Leach,** treasurer; and **J. F. McGill,** secretary.

E. H. Wegner, formerly acting works manager, is appointed general manager of manufacturing for the **Cleaver-Brooks Company.** Aiding Wegner will be **G. W. Leupold** with the responsibilities of works manager. **E. C. Uecker** is named sales manager of the Water Distillation Division with **H. E. Holbrook** as his assistant.

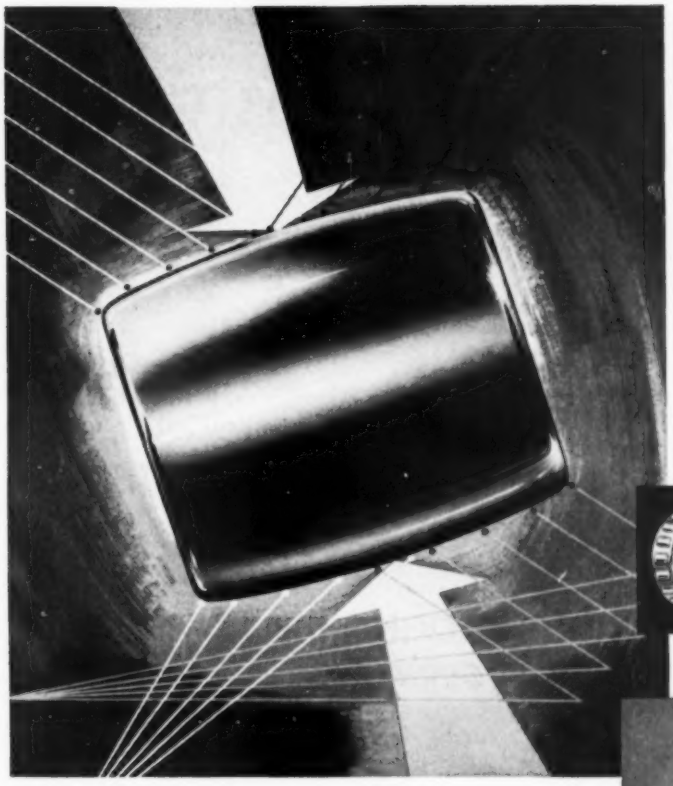
Flexonics Corporation announces the appointment of **T. K. Wells** as general sales manager. **H. W. Griesbach** is named assistant sales manager, Bellows Div. **R. H. Sabel,** formerly general manager of Midwest Roof Deck Company, is appointed to another new position, sales development manager.

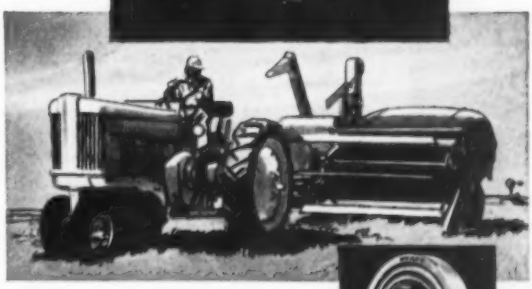
J. N. Kuzmick is appointed coordinator, corporation research and development by **Raybestos-Manhattan, Inc.** Kuzmick has been with the **Manhattan Rubber Div.** for over 30 years during which he has been active in the development of many company products.

The Automatic Control and Uni-Flo Divisions of the **Barber-Colman Co.** announce the opening of two new factory branch offices. The Indianapolis office, located at 1537 Central Ave., is headed by **Don Horock. Tom Peterson** will manage the Omaha office located at 1245 S. 13th St.

Election of new officers on the board of directors of the **C. A. Norgren Co.** is announced. **C. Neil Norgren,** assistant general manager is elected vice president and secretary. **Aksel Nielsen** is made vice president and assistant treasurer. **Leigh H. Norgren,** plant

NEW BURNER UNIT
Distinguishing features of the new Iron Fireman packaged burner unit are pointed out at a recent Midwestern dealers meeting. The unit, with capacities ranging up to 500 boiler hp, may be used for firing any type of boiler. Pictured are (left to right) R. Chatfredo, mgr, Danville Stoker Sales & Service; C. T. Burg and E. C. Webb, Iron Fireman v-p's; C. R. Klayer, owner, Danville Stoker Sales; C. F. Merrick and S. H. Beach, Iron Fireman Mfg. Co.





A new era in bearings is taking this shape...

NEW HYATT BARREL BEARING

now available in volume!

Industrial designers and engineers seldom make changes in bearing specifications. But when they discover something *really new*—like Hyatt's BARREL BEARING—out come the blueprints! *And this time they know they've got something!* Hyatt's new Barrel Bearing combines dual-purpose design with self-aligning action. It takes load from any direction and operates at full efficiency under conditions of misalignment! And, because barrel-shaped rollers provide high load capacity with low friction, this unique bearing is ideal for a wide range of applications. Best of all, the *cost* is far lower than you would expect! Find out how to improve *your* product . . . Consult a Hyatt Sales-Engineer, or write for our new Barrel Bearing catalog.

HYATT ROLLER BEARINGS

STRAIGHT · BARREL · TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION, HARRISON, N. J.

Circle 565 on Reply Card for more data

names

— Starts on page 110

superintendent, is elected treasurer and assistant secretary. **Floyd R. Pool** is assistant secretary.

The Darling Valve & Manufacturing Company announces the selection of **Frank B. Kreider** as general sales manager. For the past four and one-half years he has been eastern regional manager, Insulation Div., for **Pabco Products, Inc.**

Johnston Pump Company announces two new appointments. **C. L. Holbert,** formerly vice-president-treasurer moves up to vice-president-general manager. **Rex D. Cross,** who was district sales manager, southeastern states, takes over as national sales manager.

Consolidation of the sales divisions and the marketing & research divisions of **PROTO Tools** and all subsidiaries under the leadership of vice-president **Marvin S. Bandoli** is announced. In his new capacity as vice president of sales, marketing & distribution, Bandoli announced the appointment of **H. W. Oetjen** as sales manager for PROTO Tools.

Elliott Company announces the appointment of three commercial vice presidents, these being district office managers of long standing, who will maintain their present headquarters. **H. S. Pahren** has been New York district manager since 1946. **W. E. Widau** is the Chicago district manager as well as Mid-Western manager. **J. H. Strickler** is manager of the Pittsburgh office and is junior vice president of the Engineers Society of Western Pennsylvania.

Pahren Widau Strickler

With the dissolution of Rowan and Buchanan, former representatives of the **United States Gasket Company** in the Houston area, U. S.G. has elected to continue with the newly formed **Wm. C. Buchanan Co.** of 4101 San Jacinto St., Houston, Texas.

Appointment of **J. G. Hamm** as manager of the St. Louis sales office is announced by **The Trane Company.** New location of two sub-offices of the Greensboro, N.C. sales office is announced. The Charlotte office, managed by **Loy F. Thompson,** is located at 531 Northgate Avenue. Address of the Raleigh office is 510 Rose Lane. **Banks W. Clark** is sales manager.

J. L. Cutler is appointed technical consultant in the hose sales dept and **R. E. Mercer** is named to succeed him as assistant manager of that department at **Goodyear Tire & Rubber Co.**

Five engineering promotions are announced at **Worthington Corporation. Everett C. Schmactenberg** is appointed chief engineer of the turbomachinery engineering services. **C. J. Tullo** is named chief engineer of the Centrifugal Engineering Div. **W. H. Fraser** and **Wm. C. Krutzech, Jr.,** are promoted to assistant chief engineers of the same division. **Max Reimer** is named chief draftsman of the Harrison Works Engineering Dept., and manager of the Engineering Services Div.

A. G. Darling, an industrial power engineer with the **General Electric Company,** retired recently after 42 years' service with the company.

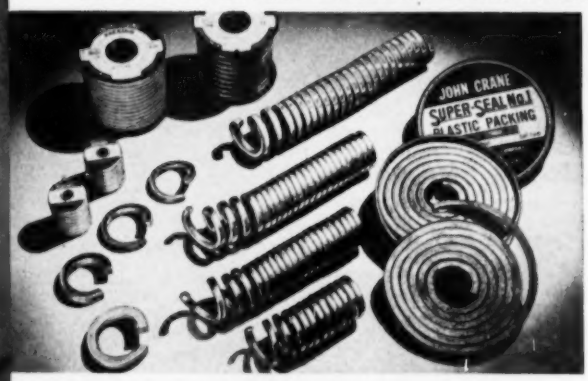
The newly established post of marketing manager of **Weston Electrical Instrument Corporation** is filled by **Charles B. Denton,** formerly advertising manager.

T. E. Hammond, formerly district sales agent in the Chicago area, is named assistant sales manager of **Erie City Iron Works.**

Peabody Engineering Corporation announces the promotion of **Wm. F. Lange** to the newly established position of assistant chief engineer.

Check with JOHN CRANE

TO GET THE RIGHT PACKING for ALL POWER PLANT SERVICES



Check your problem. It may be in the handling of boiler feed water . . . saturated or superheated steam . . . condensate . . . drain water . . . refrigerants.

Check "John Crane's" complete line of packings for the power plant. You'll find that "John Crane" engineers have designed and developed a particular type of packing to meet your individual applications or service condition.

Check "John Crane" for types and sizes. You'll find an exceptionally wide range of metallic, semi-metallic, plastic, fabric and Teflon* packings . . . spirals, coils, sheets and die-formed rings and sets to fit all stuffing boxes.

Check "John Crane" for quality and availability. Only the finest materials, binders and lubricants are used, forming a resilient, flexible, non-frictional strong packing. Completely stocked warehouses throughout United States and Canada give you prompt service in the quantity you need.

Check with "John Crane" engineers for recommendations and assistance you need for handling even your most difficult applications. Send for fully illustrated catalogs. Crane Packing Company, 1831 Cuyler Avenue, Chicago 13, Illinois.

*Du Pont trademark for tetrafluoroethylene resin.

JOHN CRANE

CRANE PACKING COMPANY

Circle 566 on Reply Card for more data

Have you a fly ash recovery problem?

Bring it to
WESTERN PRECIPITATION

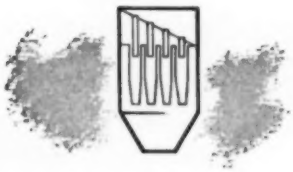
. . . The Only Organization With Years Of "Know-How" In BOTH *Electrical* And *Mechanical* Recovery Methods!

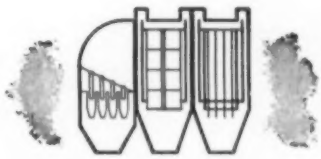
If you have any kind of a suspension-recovery problem—whether dust, fly ash, fume, fog or mists—it will pay you to bring it to the leading organization in the field . . . WESTERN PRECIPITATION CORPORATION. Western Precipitation not only pioneered, over 44 years ago, the first commercial application of the now-famous COTTRELL Electrical Precipitators, but also has been a leader for many years in the *mechanical* recovery field with its widely-accepted MULTICLONE Collectors.

Result:

Western Precipitation is unsurpassed in the all-important factor of "know-how" in BOTH the electrical and mechanical fields . . . knows from years of first-hand experience whether your particular problem can best be solved by mechanical or electrical methods—*or by a combination of the two* . . . can give you a direct and unbiased recommendation on the matter . . . and then can provide the complete installation under *one* responsibility, *one* overall performance guarantee, even where Combination Multiclone-Precipitator (CMP) installations are made!

Western Precipitation products and services include . . .





COTTRELL
Electrical Precipitators

. . . the most efficient recovery equipment for high recovery, long life, low maintenance on practically any type of suspensions, wet or dry. COTTRELLS can be designed to handle a few c.f.m. —or millions—with equal ease, and at virtually any operating temperature. Recovery efficiencies closely approach 100% recovery, if desired, with very low draft loss, minimum power costs and negligible labor costs. *By all standards, Western Precipitation* COTTRELLS *give highest recovery at lowest cost per-year-of-service!*

MULTICLONE
Mechanical Collectors

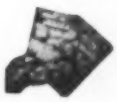
. . . the most efficient, most compact, most trouble-free mechanical equipment for recovering suspensions from gases. Because of their unique small-tube design, MULTICLONES are unsurpassed in mechanical recovery efficiencies—require less space, less maintenance, and are far simpler to install. No filters or screens to replace, nothing to burn or cause fire hazards, no high speed moving parts to repair or replace. These and many other advantages make MULTICLONE Collectors the logical choice on installations where mechanical recovery is selected.

CMP UNITS
(Combination Multiclone-Precipitator)

. . . combine, in *one* compact installation, *both* mechanical and electrical recovery principles so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally removes the larger and heavier suspensions (down to a few microns in diameter) . . . and the COTTRELL section then electrically removes the very small particles remaining in the gases. Thus, the bulk of the recovery is obtained with relatively low-cost equipment, and the final clean-up is obtained with equipment having unusually high recovery efficiency—approaching theoretically perfect, if desired.

The recovery of suspensions from gases is a highly exact science and every problem is different. Some require mechanical methods—others electrical methods—still others a combination of mechanical and electrical methods in proper balance to meet the individual requirements of each application. No matter what your problem, remember that only Western Precipitation has had years of field experience in BOTH mechanical and electrical methods!

Send for descriptive literature!



Let our experienced engineers study your recovery requirements and make an unbiased recommendation on the equipment best suited to your particular problem. A wire, phone call or letter to our nearest office places this unique "know-how" at your service, without obligation.

WESTERN Precipitation CORPORATION

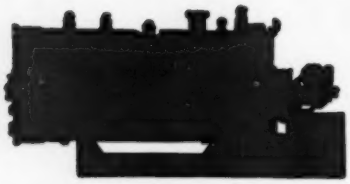
ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1016 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

MULTICLONE—T.M. Reg.

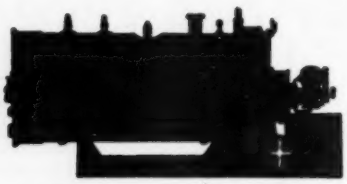
Circle 567 on Reply Card for more data

HOW SUPERIOR SOLVES YOUR STEAM PROBLEMS



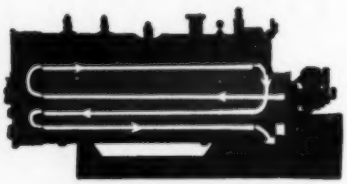
A COMPLETE PACKAGE

Completely factory-assembled and tested, a Superior Steam Generator is backed by undivided responsibility.



INDUCED DRAFT THAT'S BUILT-IN

... eliminates need of an expensive chimney ... Multiple fans draw evenly on all tubes, reducing maintenance.

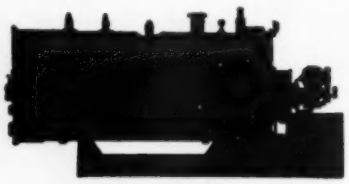


4-PASS, DOWN-DRAFT DESIGN

High gas velocities produce high efficiency. Down-draft design promotes rapid evaporation, quicker steaming.

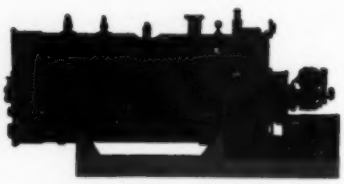
AMPLE HEATING SURFACE

A minimum of 5 sq. ft. of heating surface per boiler horsepower assures maximum efficiency at full rated capacity.



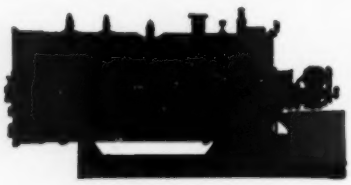
RESERVE CAPACITY

Greater steam space and large evaporating surface provide ample reserve capacity & better than 99% dry steam.



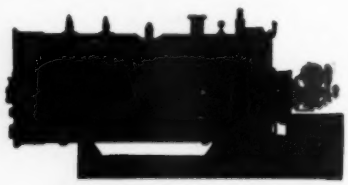
NO EXPENSIVE FOUNDATION

Built on a rigid channel iron base, a Superior Steam Generator needs only a floor capable of supporting its weight.



BUILT-IN CONTROLS

All controls essential to completely automatic operation are factory-wired into an easily accessible control panel,



BURN OIL, GAS, OR BOTH

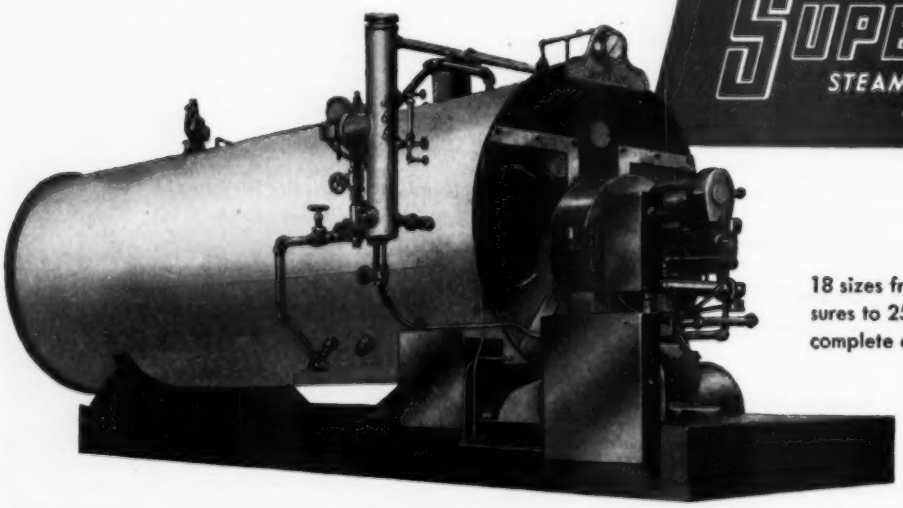
Superior Burners burn oil or gas or a combination of both ... changing from one fuel to the other in seconds.

Superior Steam Generators are the ideal choice for a new steam plant ... the simplest answer to expanding your present plant ... the easiest solution to replacing obsolete boilers.

Guaranteed to develop maximum rated capacities at thermal efficiencies in excess of 80%, their design embodies features which insure long-lived dependability and maximum fuel economy.

for performance you can **BANK** *on*

SUPERIOR
STEAM GENERATORS



18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 502.

SUPERIOR COMBUSTION INDUSTRIES INC. TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

Circle 568 on Reply Card for more data

readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 34-35 & 114-115

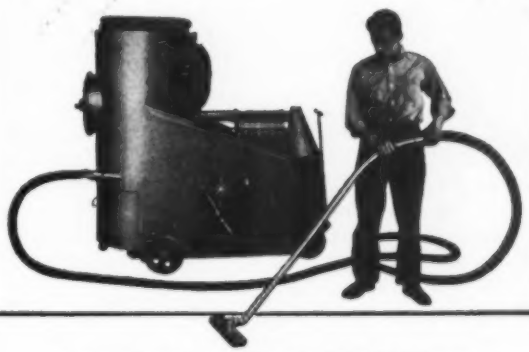
Key No.	Advertiser		Page No.
	AIR FILTERS & DUST COLLECTORS		
515	The Aerotec Corp.	Electrical precipitators	25
581	The Northern Blower Co.	Dust collectors	125
562	Prat-Daniel Corp.	Tubular dust collector	107
544	Research Corp.	Electrical precipitators	56
567	Western Precipitation Corp.	Electrical & Mechanical systems	113
	BOILERS & BOILER ACCESSORIES		
553	American Engineering Co.	Taylor Stokers	65
573	Ames Iron Works Inc.	Amesteam generator	117
552	Bell & Zoller Coal Co.	Coals	64
509	Bituminous Coal Institute	Coals	14-15
525	Cleaver-Brooks Co.	Combination gas and/or oil fired boilers	37
561	Cyclotherm Div., U. S. Radiator Corp.	Steam generators	106
502	Detroit Stoker Co.	RotoGrate stokers	4
551	Diamond Power Specialty Corp.	Boiler cleaning systems	63
564	The Engineer Co.	Enco boiler baffles	110
541	Erie City Iron Works	Keystone furnaces	53
522	Foster Wheeler Corp.	Package steam generators	33
531	Heacon, Inc.	Dampers	43
575	Henszey Co.	Feed water meters	119
545	Ingersoll-Rand Co.	Boiler feed pumps	57
549	Orr & Sembower, Inc.	Packaged boilers	61
568	Superior Combustion Industries Inc.	Package steam generators	114
557	The Wickes Boiler Co.	Steam generators	101
	BUILDING MATERIALS & MAINTENANCE		
571	Felt Products Mfg. Co.	"Hi-temp" thread compound	117
596	Flexrock Co.	Instant floor patch	134
572	Smooth-On Mfg. Co.	Iron Cement	117
569	U. S. Hoffman Machinery Corp.	Heavy-duty vacuum cleaners	115
	ELECTRICAL EQUIPMENT		
595	Acme Electric Corp.	Dry type power transformers	134
520	Bussmann Mfg. Co.	Fusetrons	30-31
546	Economy Fuse & Mfg. Co.	Fuses	58
519	General Electric Co.	Circuit breakers	29
535	General Electric Co., Construction Materials Div.	Conduit	47
529	The Hays Corp.	Electronic flow meter	41
514	Heinemann Electric Co.	Circuit breakers	24
511	I-T-E Circuit Breaker Co.	Metal-clad switchgear	18-19
580	Sorensen & Co.	A-C regulators	124
594	U. S. Electrical Motors Inc.	Syncrogear motor	132
	ENGINES & TURBINES		
534	Chicago Pneumatic Tool Co.	Diesel, dual fuel or gas engine units	46
527	Coppus Engineering Corp.	Turbines	39
513	Elliott Co., Steam Turbine Dept.	Turbines	22-23
521	L. J. Wing Mfg. Co.	Steam turbines	32
507	Worthington Corp., Steam Turbine Div.	Steam turbines	11
	HEAT EXCHANGER EQUIPMENT		
528	Niagara Blower Co.	Aero heat exchanger	40
559	Pick Mfg. Co.	Water heaters	104
	HEATING, AIR CONDITIONING & REFRIGERATION		
558	The Kirk & Blum Mfg. Co.	Ventilation systems	103
516	The Trane Co.	Gas-fired unit heaters	26
	INSTRUMENTS & CONTROLS		
583	The Liquidometer Corp.	Tank gage	127

(Continued on next page)

PROFIT by the EXPERIENCE of America's FINEST PLANTS

They REPEAT-ORDER
HOFFMAN *Heavy-Duty*
VACUUM CLEANING EQUIPMENT for Wider Range Dust Removal!

One installation sells another, as plant after plant finds that Hoffman vacuum cleaning units save labor—salvage material—reduce product defects—eliminate dust hazards. They've proved that they can clean larger areas of walls, floors and overhead surface with Hoffman equipment. Built to provide bigger capacity, higher vacuum and long years of service on the most grueling plant cleaning jobs.



YOUR CHOICE OF 4 BIG-CAPACITY PORTABLES

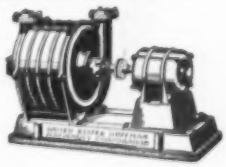
Advanced design and construction features for fast, efficient cleaning, with one-man handling. 1½, 3, 5, and 7½ H.P. models to match your specific cleaning requirements

STATIONARY SYSTEMS IN A WIDE RANGE OF SIZES TO FIT YOUR MAINTENANCE OR PRODUCTION OPERATIONS

Provides cleaning in several areas at the same time. Sweepers attach cleaning hose to conveniently located inlets (in a permanently piped system). Dust is removed pneumatically to central collectors for easy disposal.

MULTISTAGE CENTRIFUGAL BLOWERS AND EXHAUSTERS

For agitation of liquids, combustion, mixing—for all air requirements (including the elimination of compressed air). No internal moving parts. Low power consumption. Adopted as standard in steel plants, textile and ice plants requiring 24-hour continuous service. Wide range of pressures, capacities and vacuum, for air or gas. Tell us your requirements.



AIR APPLIANCE DIVISION U.S. HOFFMAN MACHINERY CORPORATION
100 EAST 42nd STREET, NEW YORK 17, N. Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO. LTD. NEWMARKET, ONT.

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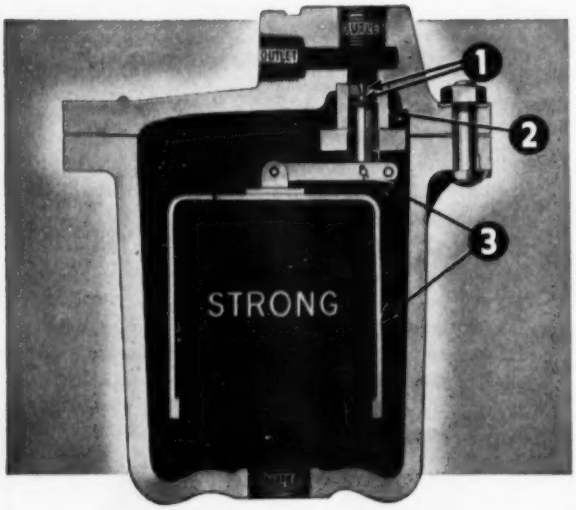
3 Reasons STRONG* Traps are easy to maintain!



Look for these three STRONG low-maintenance features in the STRONG 80 Series Inverted Bucket Trap:

1. **Anum-Metl Valve and Seat—guaranteed leakproof for one year;**
2. **Bolted-in seat design—insures tight seal, easy servicing;**
3. **Stainless steel bucket and trim.**

Compare these features with other traps!

STRONG 80 Series Trap sizes ½" to 2½", pressures to 250 lbs., temperature to 500° F. (forged steel for higher pressures).

Dual outlet simplifies piping, bottom inlet keeps trap cleaner. Years of trouble-free operation assured by super-STRONG construction.

Catalog No. 68-H describes inverted, open bucket and other types of STRONG traps. Write today.

*Trade Mark Reg. U. S. Pat. Off.

STRONG, CARLISLE & HAMMOND COMPANY

1392 West 3rd Street
Cleveland 13, Ohio

ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

Reducing Valve

70 Series Trap

Strainer

STRONG

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readers' guide

—Starts on page 115

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Key No.	Advertiser		Page No.
	LUBRICANTS & LUBRICATION EQUIPMENT		
588	New York & New Jersey Lubricant Co.	Non-fluid oil	128
582	C. A. Norgren Co.	Micro-Fog system	126
560	Shell Oil Co.	Alvania Grease	105
547	Sinclair Refining Co.	Rubilene lubricating oil	59
537	Standard Oil Co. (Ind)	Nonpareil turbine oil	49
598	The Texas Co.	Regal turbine oil	136
	MECHANICAL POWER TRANSMISSION		
501	Link-Belt Co.	Coal handling equipment	3
590	Sweet's Catalog Service	Materials handling File	129
	MATERIALS HANDLING EQUIPMENT		
565	Hyatt Bearings Div., General Motors Corp.	Barrel bearings	111
574	Lovejoy Flexible Coupling Co.	Pulleys	118
	PACKINGS & GASKETS		
566	Crane Packing Co.	John Crane packings	112
542	Johns-Manville Corp.	Packings & gaskets	54
550	Raybestos-Manhattan, Inc., Packing Div.	Packings	62
576	United States Gasket Co.	Metal-asbestos gasket	120
	PIPE, TUBING & HOSE		
587	Atlantic Metal Hose Co., Inc.	Flexible metal hose	128
533	Grinnell Co., Inc.	Pipe hangers and supports	45
593	The Ric-wiL Co.	Pipe conduit systems	132
	PUMPS & COMPRESSORS		
512	Milton Roy Co.	H-20 pump	21
539	%Proportioneers, Inc.%	Chemical feed pump	51
523	Schramm, Inc.	Air compressor	34
584	Sims Pump Valve Co., Inc.	Pump valves	127
506	Worthington Corp., Compressor Div.	Air compressors	10
554	Centrifugal Pump Div.	SESC pumps	96
	REFRACTORIES		
577	Refractory & Insulation Corp.	Refractory cement	121
536	Universal Atlas Cement Co.	Refractory concrete	48
	STEAM SPECIALTIES		
500	Armstrong Machine Works	Steam traps	2
591	W. H. Nicholson & Co.	Air-Gas traps	130
597	Sarco Co., Inc.	Steam traps	135
570	Strong, Carlisle & Hammond Co.	Steam specialties	116
530	Wright-Austin Co.	Steam traps	42
556	Yarnall-Waring Co.	Steam traps	66
	TOOLS		
526	Airetool Mfg. Co.	Tube cleaner	38
578	Elliott Co., Lagonda Div.	Handhole seat grinder	122
503	Proto Tools	Multi-purpose pliers	6
518	Snap-On Tools Corp.	Maintenance tools	28
	VALVES & REGULATORS		
532	The Chapman Valve Mfg. Co.	Check valves	44
504	Crane Co.	Angle valves	7
540	Darling Valve & Mfg. Co.	Rubber-lined gate valves	52
563	Edward Valves, Inc., Subsidiary of Rockwell Mfg. Co.	Power plant valves	108-109
505	Jenkins Bros.	Valves	9
517	Leslie Co.	Level controls	27
585	The Powers Regulator Co.	Temperature regulator	127
589	W. S. Rockwell Co.	Butterfly valves	129
538	Spence Engineering Co.	Temperature regulators	50
548	Henry Vogt Machine Co.	Valves, fittings and flanges	60
	WATER TREATMENT & WASTE DISPOSAL		
510	W. H. & L. D. Betz	Water conditioning	17
579	The Bird-Archer Co.	Water treatment	123
592	Builders-Providence, Inc.	Water conditioning	131
543	Cochrane Corp.	Solids-contact reactor	55
524	Elgin-Refin'te Corp., Div. of Elgin Softener Corp.	Water conditioning	35
555	Graver Water Conditioning Co.	Water clarifier	98
586	Hungerford & Terry, Inc.	Water conditioning	127
508	National Aluminate Corp.	Water conditioning	13

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thousands of users PROVE

"HI-TEMP"

C-5 THREAD COMPOUND

IS BEST FOR ALL STUD THREADS and STAINLESS STEEL APPLICATIONS

✔ speeds up dis-assembly time
✔ prevents stud breakage
✔ eliminates pitting of stainless steel

NO MORE FROZEN OR GALLED STUDS ...EVEN AT 1800°F

Let us SEND you a

FREE SAMPLE

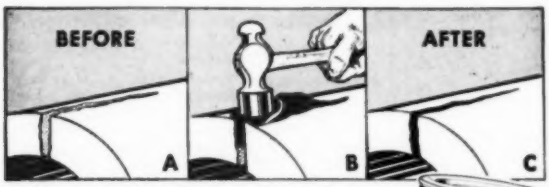
so you can PROVE to YOURSELF that C-5 will lick your toughest stud breakage problems!

To assure easy maintenance on products having threaded assemblies many leading product engineers have specified the use of Fel-Pro C-5 as an anti-seize coating on stud threads prior to final production line assembly.

Fel-Pro's exclusive Colloidal-Copper formula allows for easy separation and reduces stud breakage of threaded assemblies after long exposure to extreme temperatures. It eliminates pitting of stainless and alloy steel even where dissimilar metals are joined.

Conduct your own tests with C-5 "Hi-Temp" at our expense. Write for Free Sample and complete data sheet TODAY!

FELT PRODUCTS MFG. CO. 1542 Carroll Ave., Chicago 7, Ill.



A—Deep crack. B—Tamping Smooth-On in. C—Crack completely sealed.

If You've Never Used SMOOTH-ON, *read this:*

Smooth-On No. 1 Iron Cement is a metallic powder which you mix with water to the consistency of putty. You tamp it, while still soft, into a crack or hole, making sure to force it against all surfaces. With Smooth-On you don't need to use heat or special gadgets. As it hardens, it expands slightly, clinging tightly in place. The required part is ready for use as soon as Smooth-On sets hard. Keep Smooth-On handy for both emergency and routine maintenance repairs. Buy it in 7 oz., 1 lb., 5 lb., 20 lb., or 100 lb. sizes. If your supply house hasn't Smooth-On No. 1, write us.

FREE 40-PAGE REPAIR HANDBOOK

Shows many industrial and home repairs made with No. 1 and other Smooth-On Cements. Leaks stopped, cracks sealed, loose parts made tight. 140 illustrations. Drop us a line for Your free copy.

SMOOTH-ON MFG. CO., Dept. 19
570 Communipaw Ave., Jersey City 4, N. J.

Do it with **SMOOTH-ON**

THE IRON REPAIR CEMENT OF MANY USES

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— Just some of the reasons why so many users prefer

AMESTEAM GENERATOR

20 SIZES
10 to 600 h.p.
15 to 200#
OIL OR GAS

— and here are some others:

★ Eye-level controls — protected from dirt, water and accidental damage

★ AMES SERVICE — our **LOCAL** service man starts your unit and provides 3 months' FREE SERVICE

WRITE FOR THIS FREE BULLETIN ON CUTTING STEAM COSTS!

NAME.....

COMPANY.....

ADDRESS.....

AMES IRON WORKS INC.

BOX G-113 OSWEGO, N. Y.

Builders of Better Boilers since 1848

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JOBS LIKE THESE!

Lovejoy Countershaft Unit controls speed of automatic Spring Coiler

Lovejoy Wide V-Belt Pulley included in design of Tapping Machine

...depend on

LOVEJOY VARIABLE SPEED PULLEYS

Whatever *your* job calls for — you, too, can depend on Lovejoy Variable Speed Pulleys to operate machinery at exactly the right speed. Quick, easy, finger-tip control — no stops for speed changes. Simple installations on old or new equipment. Shipped from stock for fractional to 8 H.P. duties. And ask about the new, low-cost Lovejoy Tilting Motor Base for fractional motors up to ¾ H. P.

Write now for complete Catalog and engineering data

LOVEJOY FLEXIBLE COUPLING COMPANY

5043 W. Lake St. Chicago 44, Ill.

Also Mfrs. of Lovejoy Universal Joints and Lovejoy Flexible Couplings

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new bulletins

. . . for other bulletins just received see page 36

AIR FILTERS & DUST COLLECTORS

240—Dust Collectors

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented by means of illustrated industrial installations. Kirk & Blum Mfg. Co.

242—Integral Dust Collectors

Three folders 1-ATC-1, 2, and 3, describe integral dust collectors: construction, purpose, and dimensions; installations and case histories; and capacities. Graphs, charts, and cross-sectional drawings are included. The Aerotec Corp.

244—Tubular Dust Collectors

Problems of fly ash collection are discussed in 8-page brochure 4P201. Tubular dust collectors are described, and efficiency curves, arrangements, and standard dimensions are presented. Flue gas density tables, and a formula and nomograph for calculating the number of tubes required for any volume and resistance, are presented to aid in selecting dimensions for a unit to satisfy space requirements. The Thermix Corp.

245—Electrical Precipitator

Electrical precipitator may be used for removal of practically any solid or liquid suspended in a gas, according to 28-page brochure 195C. How it works, basic types and advantages are illustrated and discussed. Numerous specific installations are given. Research Corp.

246—Industrial Dusts

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

PROTECTIVE COATINGS

248—Rust Preventive Coatings

Complete instructions for surface preparation and application of rust preventive coatings are given in a 16-page general catalog. Color chips are included for various types of coatings. Rust-Oleum Corp.

BOILERS & BOILER ACCESSORIES

250—Steam Generators

The advantages of shop-assembled power for your plant with Type-A water tube steam generators are explained in 8-page bulletin 52-1. Line drawings show the flexibility of design possible and dimensions. The Wickes Boiler Co.

252—Draft Inducers

The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-52. Six causes of poor chimney draft are listed. Parts of a typical draft inducer installation are numbered and explained. A selector chart is included. L. J. Wing Mfg. Co.

256—Packaged Steam Generators

Construction of packaged steam generators is described in 8-page bulletin 1050. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room layout is given. Ames Iron Works.

258—Steam Turbines

Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Each component of the system is pictured and described. Worthington Corp.

260—Catalog

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in this 4-page folder. Steam generators, heat transfer equipment, pressure vessels,

PRODUCT INDEX

Air Filters & Dust Collectors	118
Protective Coatings	118
Boilers & Boiler Accessories	118
Building Materials & Maintenance	120
Diesels & Gas Engines	120
Electrical Equipment	120
Fans & Blowers	121
Filters, Strainers, & Purifiers	121
Heat Exchanger Equipment	121
Heating, Air Conditioning, & Refrigeration	121
Instruments & Controls	121
Materials Handling Equipment	122
Mechanical Power Transmission	122
Packing & Gaskets	122
Pipe, Tubing & Hose	122
Pumps & Compressors	123
Refractories	124
Steam Specialties	124
Thermal Insulation	125
Tools	125
Valves & Regulators	125
Water Treatment & Waste Disposal	126

NOTE — Each item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 114 - 115.

valves and fittings, and refrigeration equipment are pictured. Henry Vogt Machine Co.

262—Boilers

Self-contained boilers for heating and processing are described in 7-page bulletin AD-100. Design is illustrated by a cross-sectional drawing and efficiency is shown by graph. Capacity and dimension tables are included. Cleaver-Brooks Co.

264—Water Tube Boilers

Actual installations of 2-drum water tube boilers with integral water-wall elements are pictured in 20-page brochure SB43. Factory assembled units, up to 300 hp, are for underfeed stoker, spreader stoker, oil or gas firing. Larger units for field erection are shown. Erie City Iron Works.

268—Packaged Boilers

Packaged automatic boilers for light oil, heavy oil, gas, or combination gas and oil firing are featured in 16-page bulletin 1219. Ratings for 15 to 500 hp units are tabulated and installations for steam process and steam and hot water service are illustrated and described. Orr & Sembower, Inc.

276—Coal-Burning Installations

"Burning Bituminous Coal the Modern Way," contains 24 pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

280—Packaged Steam Generator

Described in a 4-page folder is the principle of Cyclonic combustion, a recently developed method of heat transfer employed in this packaged steam generator. Oil, gas, or combination burners are available. Capacities are from 18 to 500 boiler hp. Cyclotherm Corp.

288—Water-Tube Steam Generators

Data and specifications for factory assembled units in sizes ranging from 5300 to 33,000 lb per hr are presented in an 8-page brochure. For pressures up to 400 psi, they are designed to provide fully automatic firing with oil, gas, or stoker-fired coal. Superior Combustion Ind., Inc.

290—Flame Failure Explosions

"Guarding Your Properties Against Flame Failure Explosions," booklet CP21, shows how to determine whether your fuel burner is adequately protected against explosion and briefly describes equipment to provide complete protection. Combustion Control Corp.

291—Boiler Baffles

"More Steam from Your Boilers," a 4-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

292—Oil Burners

Units with capacities from 5 to 60 gpm are described and illustrated in 8-page catalog Ad-102. Heavier grades of fuel oil, up to No. 5, can be utilized. Construction features, advantages, and specifications are given. Cleaver-Brooks Co., Hev-E-Oil Burner Div.

293—Fuel Oil Preparation

New packaged units designed to provide an efficient and economical means of straining, heating, and pumping Bunker "C" or other grades of fuel oil used in oil burners are described in bulletin 16-H. These units are widely used in power

BUILT TO TAKE PUNISHMENT

HENSZEY *Feed Water* METERS

Notice the simplified, rugged construction of the inside mechanism of the Henszey Meter. The rotor (directly connected to the gear train) fits into the measuring chamber without close clearances. Bearing surfaces, shafts and bushings subject to friction and hard wear are made of tough, long-wearing Stellite. Calibrations of the straight-reading horizontal register can be made to read in gallons, pounds, or cubic feet at any specified temperature.

Yes, that's why Henszey Meters are used for dependable, accurate measurement of boiler feed water, boiler blowdown, condensate, chemicals and other similar liquids. Send for bulletin.

HENSZEY CO. Dept. A-11, Watertown, Wis.

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Flow Indicators • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

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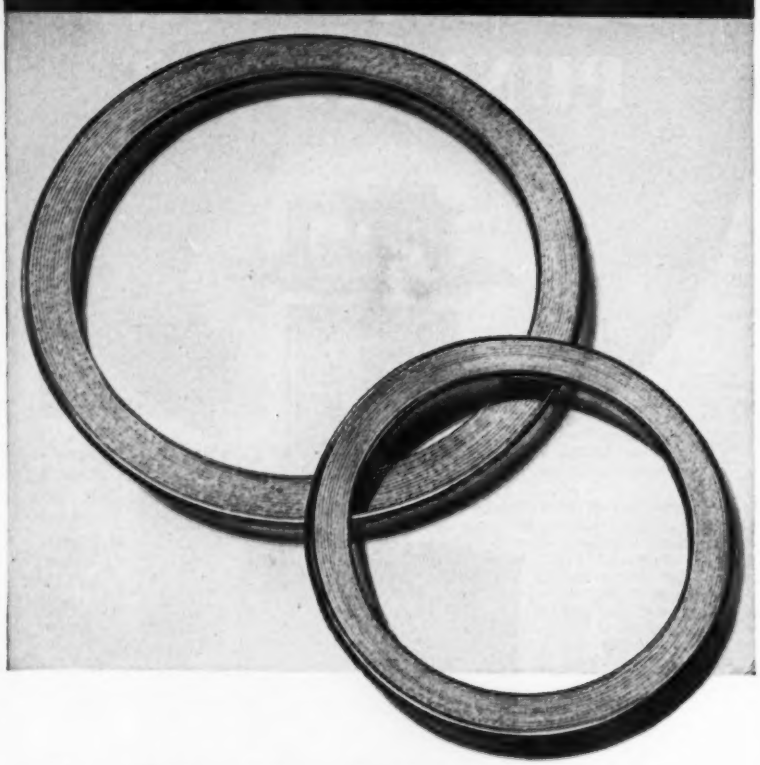
SPIRALWOUND



World's Most Popular Type Metal-Asbestos Gasket

Spirally wound Type Gaskets deserve their popularity because they offer a built-in resiliency, for safe seals with lighter bolt-loads, that no other gasket type offers.

Ajax Spiralwound Gaskets are made for all standard pipe flanges and for manholes, handholes and tube caps of all makes of stationary and marine boilers, waterwalls, economizers, and other boiler accessories.

They are available in plated low-carbon steel or stainless with fillers of Canadian or blue African Asbestos or chemically inert duPont Teflon.

Ask your Industrial Distributor or write—

UNITED STATES GASKET COMPANY

FABRICATORS OF "TEFLON" & "KEL-F" FOR THE CHEMICAL PROCESS & ELECTRONIC INDUSTRIES

CAMDEN 1 NEW JERSEY

Representatives in Principal Cities Throughout the World

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bulletins

(Starts on page 118)

plants and boiler rooms of utilities, institutions, and factories. Duplex construction of these units insures dependable and uninterrupted service in that while one system of pump-heater-strainer is on the line, a second system is in a stand-by position ready to be put into use at any time. Schutte and Koerting Co.

BUILDING MATERIALS & MAINTENANCE

294—Tube Cleaners

Equipment for practically every tube cleaning operation is presented in 28-page catalog Y-29. Specifications for cutter heads, drills, brushes, and motors are listed in illustrated tables for quick reference. Cutaways show design features of air, steam, water, and electric powered motors. Applications of standard equipment as well as a few special applications are discussed. Accessories such as lubricators, valves, operating hose, and couplings are also presented. Section on care and operation of tube cleaners and table of inside diameters for tubes and pipes add to the booklet's value. Elliott Co., Lagonda Div.

TO REQUEST FREE BULLETINS
Circle "key" numbers on Reply Card between pages 114 and 115. Your requests will be handled promptly.

296—Thread Compound

A data sheet gives complete information on C-5 "Hi-Temp" thread compound. A sample will be sent along with the data sheet. Felt Products Manufacturing Co.

298—Vacuum Cleaning Equipment

Heavy duty industrial, portable cleaning machines are described in 4-page folder A-752. A cross-sectional drawing shows the operating parts of the unit. Sketches point out the advantages of construction. U. S. Hoffman Machinery Corp.

299—Iron Cements

Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet. Iron cements for many uses are described. Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing advantages and how to apply concrete paint No. 15, for interior or exterior use. Smooth-On Manufacturing Co.

DIESELS & GAS ENGINES

300—Diesel Engines

Smaller and lighter, but for heavy-duty service is the description of a diesel engine discussed in 12-page bulletin 10027. Three models are listed, ranging from 200 to 380 hp at 900 to 1000 rpm. Specifications and performance curves are included. Ingersoll-Rand Co.

ELECTRICAL EQUIPMENT

302—Circuit Breakers

"What You Should Know About Circuit Breakers," 16-page manual 101, explains

the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Explanations, charts and diagrams deal with temperature factors, inrush current effects, tripping and reset time, quick and slow make-and-break, and wire deterioration rates. Heinemann Electric Co.

304—Dry Type Transformers

How to use dry type transformers profitably in your plant is explained in folder DT 195 which also includes wiring diagrams. Acme Electric Corp.

306—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages, the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electrical Motors, Inc.

308—Distribution Practices

"Industrial Power Distribution Idea Book," GEA5900, 28-pages, has been published as a guide on distribution practices in large and small plants. General Electric Company.

FANS & BLOWERS

314—Centrifugal Blowers

Descriptive material on centrifugal blowers, manufactured by this company, is included in 24-page catalog B-10. Dimension drawings and complete air delivery tables are given for each model. Hartzell Propeller Fan Co.

FILTERS, STRAINERS & PURIFIERS

335—Twin Strainers

Twin strainers for filtering foreign matter from oils, grease, tar, glue, sugar juice, and similar viscous fluids are described in 4-page leaflet, A-17. They are available with inlet sizes from 1 through 10 in. for working pressures to 500 psi. Elliott Co., Accessories Dept.

HEAT EXCHANGER EQUIPMENT

340—Temperature Control

A simple method of controlling the temperature of liquid or gas is explained in 4-page folder 120 on heat exchangers. Cutaway drawings illustrate how the units operate and flow diagrams show how controls keep a fluid at uniform temperature. Niagara Blower Co.

HEATING, AIR CONDITIONING & REFRIGERATION

348—Water Heaters

Answers to your hot water problems are given in booklet "Methods and Means." Operation and advantages of the instantaneous water heater as compared to the indirect method heater are discussed and illustrated. Pick Manufacturing Co.

350—General Catalog

Bring your quick reference file up to date with 36-page catalog PB-290. Condensed descriptions, data, applications and photos for full line of air conditioning, heating, ventilating and heat transfer equipment have been conveniently arranged for easy reference. Also lists bulletins available for more complete information on each product. The Trane Co.

INSTRUMENTS & CONTROLS

360—Mold Temperature Control

Discussed in 8-page technical bulletin 7

As much as
10 years' service
without replacement

That's only one of many records for

MOLDIT CASTABLES
in ash hoppers

✔ A large power plant had to repair a number of ash hoppers, remove spalled and shaled fire brick and replace with new material. Estimated cost—$30,000, plus considerable boiler outage. But R & I recommended thorough raking out, cleaning and wetting down of all broken, spalled and eroded areas, and the holes and openings filled and plastered with Moldit-D Refractory Cement to a smooth, level surface. This was done more than 10 years ago. Today the Moldit-D refractory is still in place, withstanding hard usage and frequent, large quantity cold water quenchings of the hot ash. All this at about one-fourth the estimated cost!

✔ Heavy repairs to ash hoppers with prolonged shut-downs used to cost another large power plant many thousands of dollars until they tried Moldit-D. As a result, maintaining these hoppers of eight 500,000-lb. stoker-fired boilers as well as a number of smaller boilers has been cut about 90% a year.

✔ The Moldit-D linings installed eleven years ago in ash hoppers of two 800,000-lb. pulverized fuel boilers are still going strong. Not a single repair has been necessary! The original application was made on the walls and ends of the hoppers, at a cost of a few cents per pound, plus very little labor. Figure this out in terms of labor and material for equivalent fire brick lining including the cost of maintaining and repairing it for eleven years. It would be staggering!

The Moldit success story is endless—wherever refractory linings are used. There's a Moldit Cement for every castable refractory need.

Pour It—Gun It—Trowel It—MOLDIT

REFRACTORY & INSULATION CORP.

R&I

REFRACTORY BONDING AND CASTABLE CEMENTS
INSULATING BLOCK, BLANKETS AND CEMENTS

130 WALL STREET • NEW YORK 5, N. Y.

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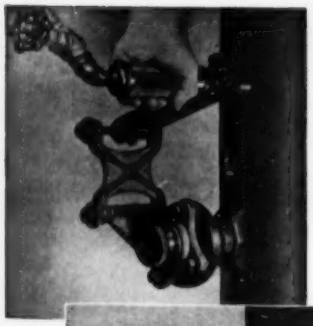
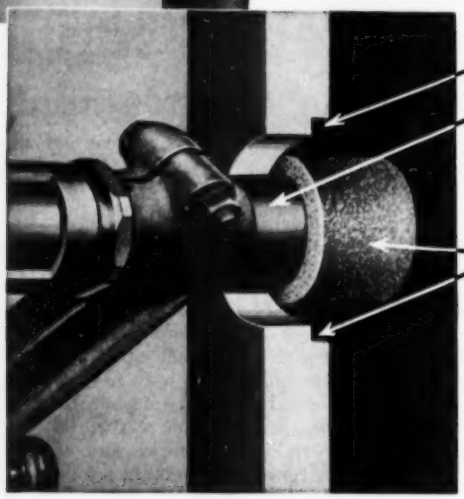
Quick, easy and accurate job on refacing handhole seats with the



ELLIOTT HANDHOLE SEAT GRINDER



WIDTH OF SEAT *controlled by* **GUIDE ROLLER** *available in all sizes for seat widths from 3/16 in. to 21/32 in.*

GRINDING WHEEL *acts as a surface grinder and is rigidly precision-controlled to move in a single plane which is the face of the seat, assuring positive flatness and a sure-tight seat.*

Here is the modern time-saving and surely accurate way to reface handhole seats that have become corroded, scarred or wire-drawn. The grinding wheel of the Elliott handhole seat grinder is first inserted in the handhole to be refaced, then the base of the unit is clamped rigidly to the stud of an adjacent handhole, and leveled by adjusting the leveling screws. The plane of grinding, vertical to the axis of the hole, is fixed as to depth by the adjusting feed nut.

Setting up takes only a few minutes and the actual grinding only a few minutes more. Compare that to the labor and inevitable inaccuracy of hand filing or of a hand-held power grinder. Consider too, the certainty of *knowing* you have a tight seat, instead of the anxious testing and finding you haven't, when the pressure ultimately goes on.

Available with air drive, or electric motor as shown above. For details contact your local Elliott representative or write Elliott Company, Springfield, Ohio.

ELLIOTT Company

LAGONDA DIVISION

Y3-2

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bulletins

—Starts on page 118

is the problem of maintaining proper temperature control of injection molding equipment. Included is a chart which lists the mold difficulties which occur with various thermoplastics when the temperature is too high or too low. Features of a heating and cooling unit are detailed. Sarco Co., Inc.

362—Instrumentation

Illustrated 8-page booklet R-8, entitled "Results," presents the case history of a large independent electric power producer. In addition to discussions of the use of steam, fuel and ash handling, and plant steam demand, the combustion control system is also fully described and illustrated. The Hays Corp.

MATERIALS HANDLING EQUIPMENT

370—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 2410, illustrate the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

MECHANICAL POWER TRANSMISSION

380—Fluid Drives

Units specifically designed for industrial use are described and illustrated in 27-page bulletin 2485. Graphs highlight the features of these packaged power units and drawings show possible arrangements. To help in selection are six pages of specifications. Link-Belt Co.

382—Electric Clutch

Principles of operation of an electrically controlled clutch are explained in 16-page bulletin 5306. It gives engineering information on how to apply, how it operates, and control. Specifications are listed. Rectifier Div., I-T-E Circuit Breaker Co.

384—Rubber Bearings

A 34-page catalog describes the uses and advantages of rubber bearings when applied to industrial equipment. Catalog contains engineering data of interest to plant engineers and tells how these bearings are applied to pumps, agitators, and similar equipment where bearings can be lubricated with water or by the liquid handled in the equipment. Bearings are available in complete range of sizes and are made of rubber compounded to resist wear and heat. B. F. Goodrich Co.

PACKING & GASKETS

390—Power Plant Applications

How to get the best results from packings is outlined in useful 6-page folder PK-61-A entitled, "Packings for the Power Plant." Each of 28 types of packings and gaskets is illustrated, briefly discussed and numbered for quick reference. These numbers are then used on a schematic drawing of a power plant to indicate recommended applications. Johns-Manville.

PIPE, TUBING & HOSE

396—Prefabricated Conduit System

Introduced in 4-page folder 5210 is a

newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. Also included are traps, valves, and expansion devices. The literature explains how the system is installed and stresses the simplicity of making joint connections. The Ric-wiL Co.

PUMPS & COMPRESSORS

406—Rotary Pumps

Two types of rotary pumps engineered and manufactured to handle any type of liquid—from gasoline to heavy black strap molasses—are described in 43-page bulletin L51A. Each model is treated in a separate section with cross-sectional drawings, graphs, and data tables. Kinny Manufacturing Co.

408—Controlled Volume Pumps

Design features and construction of motor-driven controlled volume pumps are detailed in 40-page booklet 553. Technical data include capacity adjustments, standard and special designs, and packaged systems. A 2-page chart describes typical applications in 6 major industries. Milton Roy Company.

410—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

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411—Chemical Feeder

Construction and advantages of a heavy duty, positive displacement, diaphragm pump, designed to feed corrosive fluids used in industrial processes, and in treating water and sewage, are stressed in 4-page folder 12-1. A table lists a few of the chemical solutions and concentrations that can be handled. Operating data and a performance curve also are given. Proportioneers, Inc.

412—Centrifugal Pumps

An overall line of centrifugal pumps covering a wide variety of applications and offering maximum interchangeability of parts is described and illustrated in 4-page folder W-300-B4. Graphs show coverage of the different pumps available. Worthington Corp.

414—Metering Pumps

Pumps for small manufacturers, pilot plants, and research, as well as for processing small quantities of valuable fluids, are the subject of two bulletins, H2OM and 653. Materials of construction, capacities, and design features are given, as well as a list of related technical papers and bulletins. Milton Roy Co.

416—Centrifugal Pumps

General purpose, cradle-mounted centrifugal pumps are the subject of 16-page brochure 7223. Five basic cradle groups and 17 corresponding pump types are presented. Capacities of 5 to 2400 gpm are listed for pressures of 10 to 500 ft total head. Dimensions, applications, and a table of performance are included. In addition,

Laboratory demonstration shows foaming of highly alkaline solution in glass test cylinder.

Same solution after addition of 12 ppm of Bird-Archer Concentrol antifoam.

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LOW COST CHEMICAL METHOD

FOR CONTROLLING FOAM

AND BOILER WATER CARRYOVER

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Concentrol is supplied in liquid, powder or briquette form—can be fed either continuously or in slugs to boilers. Formulations of Concentrol can include organic sludge conditioning agents and other water treatment chemicals for boiler treatment as well as antifoam. Concentrol eliminates the need for costly pre-treatment of water and high blow-down rate. It is fast acting and resistant to hydrolysis or breakdown under normal boiler temperatures and pressures.

A Bird-Archer 8 Point Service Engineer is as near as your phone. For friendly counsel call him or write directly to Bird-Archer outlining the details of your boiler operations.

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Voltage to the four RF generators varied greatly due to constantly changing loads throughout the plant. The serious fluctuations necessitated the repair of 5% of total output and scrapping of another 5% as total loss. Unsuccessful attempts were made to remedy the condition through the use of additional and separate service transformers.

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We know that a great many manufacturing difficulties are caused by line fluctuations, most of which could be eliminated quickly and economically by Sorensen AC Regulators. Find out more about this, at no obligation. from your Sorensen representative — write us for his address. Sorensen & Co., Inc., 375 Fairfield Avenue, Stamford, Conn.

SORENSEN

SORENSEN AND COMPANY 375 FAIRFIELD AVENUE, STAMFORD, CONN.

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bulletins

(Starts on page 118)

special purpose units and design modifications are described. Ingersoll-Rand Co.

418—Vertical Pumps

"Vertical Pumps for Volatile Fliuds," 6-page folder 1026, appraises the advantages of vertical turbine pumps for handling such liquids as gasoline, diesel fuel, crude oil, L-P gases, and ammonia. Efficiency curves are included in the engineering data. Johnson Pump Co.

420—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacities to 1000 gpm, pressures to 1200 psig, and temperatures to 350 F. Typical applications are tabulated. De Laval Steam Turbine Co.

422—Air Compressors

Descriptions, design features, and specifications for industrial air compressors are contained in 16-page brochure 5110-A. Models are for belt or direct motor drive from ½ to 100 hp. Accessories and controls also are described. Schramm, Inc.

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REFRACTORIES

430—Refractories & Insulations

Catalogs R-52 through I-93, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. An index is included for quick reference. Refractory & Insulation Corp.

432—Heat Resistant Concrete

Useful engineering data and information pertinent to the structural design of refractory and heat-resistant concrete is contained in illustrated 12-page booklet PP-5M. Subjects such as strength, volume changes, methods of reinforcing, sprung arches and domes, application to ducts, and stack linings are dealt with. Universal Atlas Cement Co., Lumnite Div.

STEAM SPECIALTIES

450—Steam Traps

Catalog 68G, 31 pages, describes and illustrates steam traps, strainers, regulating and reducing valves, separators, and vacuum and lifting traps. Included are applications, dimensions, and a handy steam properties table. Strong, Carlisle & Hammond Company.

452—Steam Traps

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting and repair. Numerous types of steam traps also are described. Armstrong Machine Works.

454—Steam Accumulators

Balancing steam supply and demand with steam accumulators is the subject of 8-page bulletin RA-52-8. Typical installations, principles of operation, and advantages are discussed, and data are presented for calculating capacity. Foster Wheeler Corp.

456—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, eliptical, and cylindrical shapes are presented in 8-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

458—Trap Selector

Handy, 20-page bulletin T1750 lists common industrial and process equipment and shows how to select proper size trap for each type. Tables show trap capacities, factors of safety, and pressure conditions. Installation recommendations also included, making this selector particularly useful to engineers who have many applications for steam traps. Yarnall-Waring Co.

459—Separators & Purifiers

Live steam, exhaust steam, air and gas, and receiver type separators, and steam purifiers and exhaust heads are described in 24-page catalog 500. Charts give pressure drop, steam capacity, and air capacity. Wright-Austin Co.

460—Unit Heater Steam Traps

The question of how to figure condensing rates and select proper steam traps for draining unit heaters is answered in 8-page booklet 231. Output ratings for heaters from various manufacturers are listed, and constants are given for conditions other than specified. Armstrong Machine Works.

THERMAL INSULATION

461—Insulation Specifications

Engineers who must specify thermal insulations in oil refineries and chemical process plants should find a useful source of quick reference in 52-page brochure IN-128A. Specifications are listed for thermal insulations on various types of equipment. A complete service, including materials, engineering, and application is offered. Johns-Manville.

TOOLS

462—Tool Catalog

Catalog U is a handy 104-page reference book of 4000 time-saving tools for maintenance and production. Lists all sizes and types of wrenches from largest needed on heavy machines to small ones for use on delicate instruments. Includes special equipment for repair of diesel and other engines. Snap-On Tools Corp.

464—Condenser Tube Inserts

How to restore leaking condenser tubes to service by sealing off the deteriorated portion with inserts, is the subject of 4-page leaflet 500. Tube cleaners, expanders, and maintenance tools are listed. Thomas C. Wilson, Inc.

VALVES & REGULATORS

466—Cast Steel Valves

Booklet 12-C, 56 pages, contains information on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Construction and specifications for globe, angle, and check valves in 300, 600, 900, and 1500 lb pressure classes are given.

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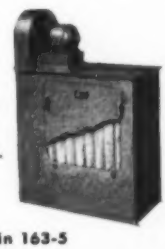

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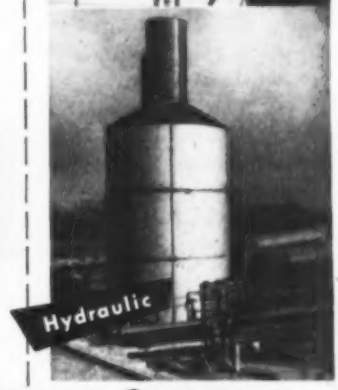

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bulletins

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Also discussed are parabolic disk valves for hand or motor control of volume. Edward Valves, Inc.

468—Temperature Regulator

Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning, and rinsing solutions. The Powers Regulator Co.

470—Reducing Valves

Four-page folder 511-A lists actual small flow reducing valve capacities based on test data. Cross-sectional-drawings show construction of the bronze and steel valves. Leslie Co.

472—Solenoid Valves

Such solenoid valve specialties as single step valves, two step valves, normally open or closed valves, three and four way valves, and remote control valves are described in 20-page booklet 700. Applications, service, operation, and construction are presented for each unit. Tables list specifications, and drawings indicate design features. Davis Regulator Co.

474—Boiler Service Valves

Surface blow, bottom blow-off, water column blow-off, and connections are covered in 22-page bulletin E125, with complete specifications, materials, and dimensions of each type. Valve operation is explained by illustrations. Fire protection valves are included. Everlasting Valve Co.

476—Regulating Valve

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in 4-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

WATER TREATMENT & WASTE DISPOSAL

490—Water Analysis

Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

492—Chlorinizers

Chlorination—the modern way to prevent slime buildup in condensers and heat exchangers—saves you money if its right. But if dosage is too heavy, you run the risk of corrosion, according to application memo 840-J9. Chlorinizers available in three volumetric models for feeding from a few pounds to 6000 pounds per day are described. Builders-Providence, Inc.

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494—Water Treatment

Laboratory pictures in this 4-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

495—Water Conditioning

Conditioning for boiler, process, and general applications is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems are explained. Elgin Softener Corp.

496—Water Softening

Bulletin WC-108, 12 pages, explains the distinction between the sodium and hydrogen cycle, and shows differences in results obtained by the two processes. Design and operation of zeolite equipment is described, and available methods for controlling various operations are discussed. A simple method of sizing such softeners and a table of recommended flow rate aids are given. Graver Water Conditioning Co.

497—Zeolite Softener

Bulletin 4520-A contains an explanation of zeolite water softening, data for laying out a softening plant, equipment size, selection of zeolites, and description of the operating stages of such softeners. A single control valve featuring 6 valves in one is also discussed. Cochrane Corp.

498—Ion Exchange

"Demineralization Including Silica Removal by Ion Exchange," 28-page booklet 3803, describes applications, principles of operation, design features, and advantages, and gives recommendations and specifications for demineralizing and silica removal apparatus and synthetic resins. The Permutit Co.

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PRODUCTION INCREASED 1000%. A Norgren Air Pressure Regulator, Filter and Micro-Fog Lubricator safeguard the high speed, automatic operation of this compact unit made with 4 Bellows Air Motors and a Bellows Rotary Feed Table. It handles 4 stages in the assembly of valve parts with a production gain of 1000% over the previous methods used.

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Norgren Micro-Fog lubrication systems have enabled hundreds of plants to obtain greater flexibility in plant layout; improve equipment performance; and reduce maintenance costs.

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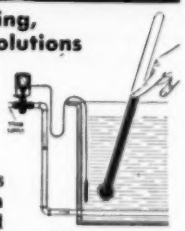

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Plastic Thermal Bulb and Tubing is highly resistant to solutions used in above processes. Prevents electrical shorts. No insulators required for the regulator.

Easy to Read 4" Dial Thermometer indicates temperature of liquid being controlled and makes it easy to adjust regulator for different temperatures.

Bulletin 330 fully describes this simple, self-operating regulator. May we send you a copy? (b30)

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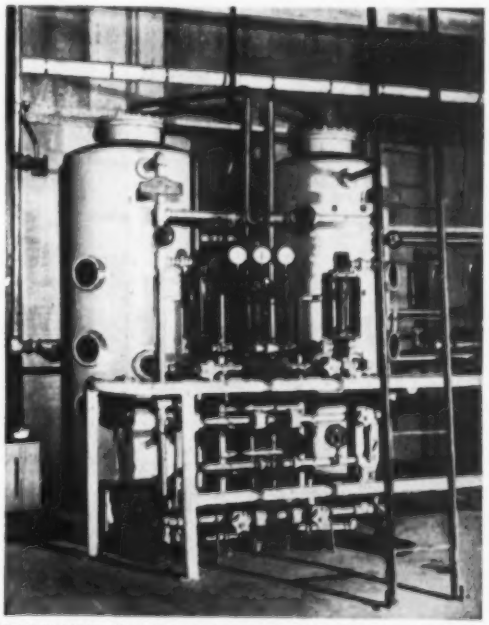

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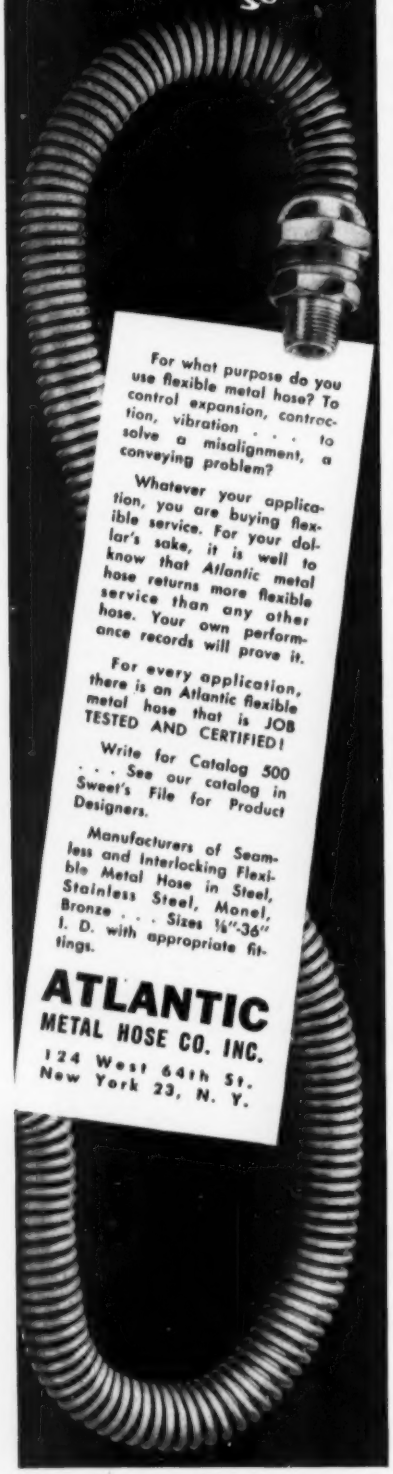

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. . . of special interest

PUMPS, 2nd Edition, by Frank A. Kristal and F. A. Annett, McGraw-Hill Book Co., 373 pages, $6.50.

This is the second edition of a volume presented by the authors in 1940. Avoiding purely theoretical discussion or the presentation of any design factors and design methods, the authors have approached their subject with a view of making the general principles of pumping and the understanding of various construction details and pump types acceptable to the reader regardless of the extent of his formal education.

The book presents first a group of chapters on the construction of various reciprocating, centrifugal, propeller, deep-well, and rotary pumps. It follows with a more detailed discussion on certain special services and applications, such as boiler feed, sewage, sanitary, and proportioning service. A chapter is devoted to the methods of priming pumps, a problem which is little understood by many operators.

It continues with a discussion of *head* and *capacity* requirements, covering the allied problems of lift, effect of specific gravity, viscosity, etc. An interesting chapter describes methods to be used in evaluating the most economical pipe size for a given installation. The book closes with chapters on pump operation, installation, maintenance, and correction of troubles.

The Appendix carries such useful tables as friction losses through rubber hose, equivalents of liquid measures, pressures and other conversion factors, data on irrigation requirements, and swimming pool applications. Such data will be useful to personnel engaged in small pump installations.

The authors have made liberal use of illustrative material supplied by the major portion of the pumping industry. One might complain that equal prominence may have been given to certain very special types rarely encountered in practice or that some of the illustrations are actually obsolete. The criticism, however, is not a very weighty one.

It is also somewhat unfortunate that the authors have retained in this edition certain term definitions from their first edition, terms which in the mean-

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For Low Overhead

The dripless, waste-less quality inherent in NON-FLUID OIL eliminates oil showers from overhead machinery of all kinds including cranes and motors. Consequently, spatter-free NON-FLUID OIL reduces cleaning time, lessens fire hazards, and lowers oil and application costs.

NON-FLUID OIL is a specialty lubricant . . . sold only on a performance basis. It is produced in special grades for a specific lubrication job . . . every grade tested under actual load conditions to assure its superiority over ordinary oils and greases.

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Also represented in other principal cities.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

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time have become superseded by a more exact terminology. A case in point is the term *total dynamic head* which has been abandoned by the body of pump manufacturers for the simpler term *total head*.

This book should be of particular interest to the non-specialist who finds himself confronted with the application of pumping machinery at rare intervals, and hence seldom has the opportunity of becoming intimate with the problems involved.

ALSO AVAILABLE

DIESEL ENGINEERING HANDBOOK, 8th Edition, Diesel Publications, Inc., 827 pages, $7.50. Subjects common to all diesel engines, regardless of make, are treated in a comprehensive manner.

Of particular interest is Chapter 11, which debunks the theory that thermal efficiency is a function of the compression ratio rather than of the expansion ratio only.

This is the first edition of the handbook to include a description of the Miller Internal Combustion System.

TECHNIQUES OF PLANT MAINTENANCE AND ENGINEERING, 1953, Proceedings of the 4th Plant Maintenance Show, Cleveland, Ohio, 1953; Clapp and Poliak, Inc., 288 pages, $6.00. If you are faced with a problem of setting up or modifying a maintenance system, many and various types are laid out for you in this work. If you feel your maintenance setup needs some reorganizing and you would like to take a two-weeks trip through some neighboring plants to see how they do it, you can take the trip in your easy chair by the reading route.

Included are sections on how to work with other staff groups in the company—industrial, engineering, accounting, purchasing, and labor relations.

INDUSTRIAL FILMS

"MECHANICAL SEALS," 20-minute, full-color, Byron Jackson Co., Los Angeles 54, California. Designed for showings to engineering and maintenance meetings, this film covers mechanical seals from design to maintenance, various seal types and their applications. Animated drawings illustrate seal operation. A condensed transcript is available in bulletin form.

"MINIATURE BEARINGS," 16 mm, sound and color, 15 minutes, Miniature Precision Bearings, Inc., Keene, N. H. The film describes the manufacture and inspection of miniature bearings and their application to precision mechanisms. It shows in detail how bearing rings are machined and polished and how the complete assembly is tested for concentricity, torque, ring diameter, and other dimensions and characteristics.

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was designed to seal off hydrocarbon vapors at 15 p.s.i. and 100°F. In actual tests with the Rockwell plastic lubricant seal, it gave air-tight shut-off to 50 p.s.i.

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These manufacturers' catalogs are instantly available in Section 1A of your Plant Engineering File:

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Cleveland Crane & Engrg. Co.	U. S. Rubber Co.
Faultless Caster Corp.	Wright Hoist Div.

In other sections of the File you will find additional catalogs containing useful information on a wide range of products used in the maintenance of all plant facilities.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street, New York 18, N. Y.

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spot news

—Starts on page 102

carbon steel. It is flowed over the electric arc to exclude chemically active gases from contact with the molten metal. Less argon is required than any other inert gas, it provides a more stable arc, and practically all metals can be welded without the use of flux.

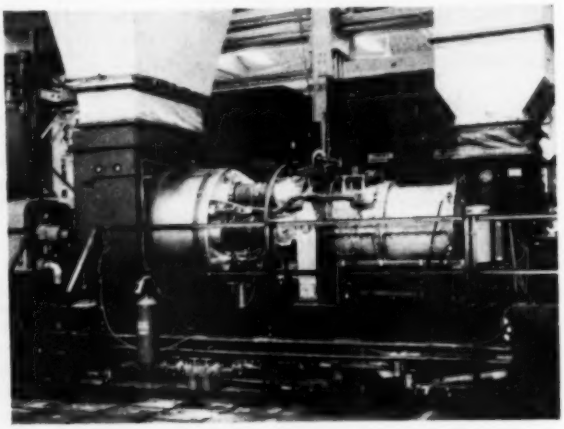
Special welding machines have been developed that automatically, by solenoid operated valves, control the flow of gas to the tip of the tungsten electrode.

Mobile Units Used to Detect Cause of Radio Interference

Plants with high frequency installations often receive complaints from residents in the area who are plagued with radio and television interference. To pinpoint the trouble, Thermatron Div., Radio Receptor Co. has equipped station wagons with test instruments capable of making precise field measurements to determine compliance with Section 18 of FCC regulations. The units are easily handled by two-man crews and can cover large areas in any direction around the suspected plant, checking interference in a minimum of time.

If the plant is not at fault, Radio Receptor Co. is authorized to issue certification showing compliance with FCC regulations. If there is interference, the engineers are prepared to suggest proper shielding.

The cars have two antennas mounted on the top, and two sets of instrumentation behind the driver's seat that cover the range from 15 mc to 300 mc. To facilitate the work there is a two-way radio-telephone link between the field car and plant. Another special device applies a tone to the intercom system whenever the source generator is in operation. If the latter is keyed on and off, identification of the signal is made certain.



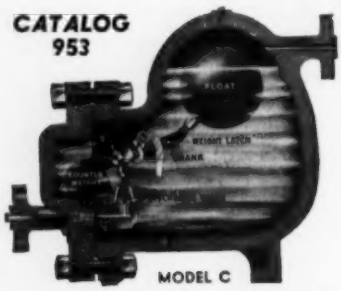
Petro-Chemical Industry Uses Gas Turbine

The first gas turbine in the petro-chemical industry is being installed at one of the major refineries of the Esso

Solve Sludge Problem with Nicholson's AIR-GAS TRAPS

With the introduction of an exclusive oil-eliminating feature, Nicholson air and gas traps now enable you to enjoy the advantages of the positive intermittent action of a float-operated air trap without the common problem of oil congealing on the mechanism and impeding or stopping its action. Other features of Nicholson traps: 1) No air-wasting vent, such as is in all inverted bucket traps. 2) Positive water seal of valve. 3) Large orifice keeps valve clean, preventing blow-through. Three types; press. to 1500 lbs. These traps are also for steam.

CATALOG 953

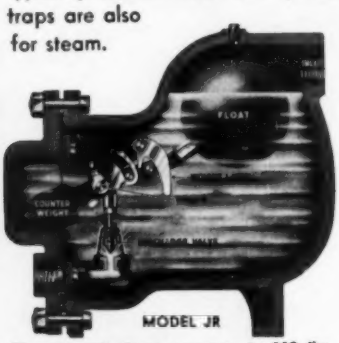


MODEL C

Air, gas and steam pressures to 1500 lbs.

MODEL WO

Air, gas and steam pressures to 650 lbs.



MODEL JR

Air, gas and steam pressures to 200 lbs.

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135 OREGON ST., WILKES-BARRE, PA.

Representatives, in 58 Key Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

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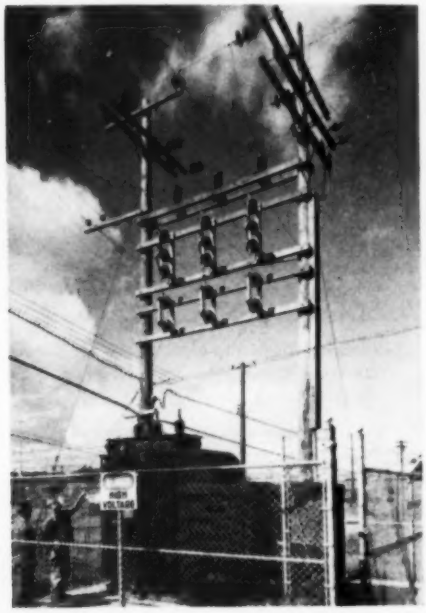
Standard Oil Company. The 5700 hp turbine will drive a three-case, 16-stage centrifugal compressor that compresses hydrocarbon gas from atmospheric pressure to approximately 285 psig.

Speed will be controlled throughout the normal operating range of 6400 rpm by means of a pneumatic controller which adjusts a fuel valve to maintain the desired compressor suction pressure. Using natural gas as its fuel, the General Electric Co.'s simple-cycle locomotive-type turbine will exhaust to a waste-heat boiler to produce low-cost process steam.



Modern Power Distribution System Installed at Arsenal

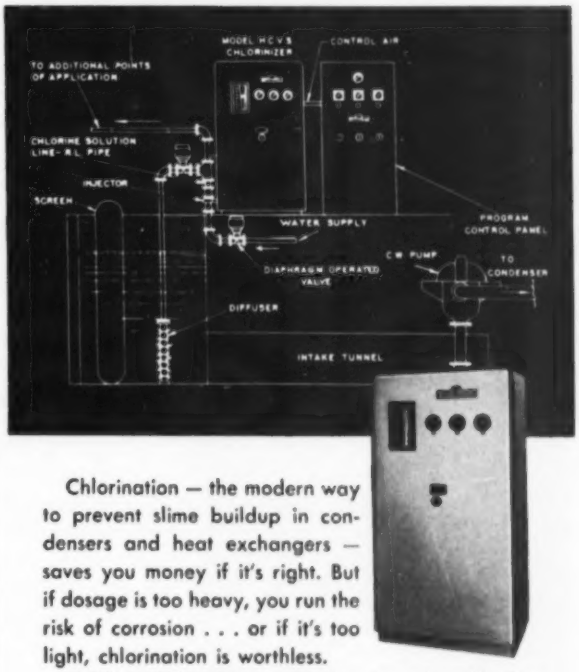
Benicia Arsenal, on San Francisco Bay, one of the largest Ordnance Depots in the west, now boasts one of the most modern large army power distribution systems in the United States. To keep up with load requirements, the arsenal went from an inadequate single-phase, open-conductor, low-voltage type distribution (total load 3000 kva), to a modern, three-phase, metal-enclosed system (total capacity 9750 kva), which consists of three substations, each located in the center of a predominate load area.

The largest substation (Station A) includes two 3-phase 3000 kva transformers which transform 22.4 kv incoming power to 2.4 kv. The high voltage power to the transformers is carried underground by cable from a switching point on the edge of the property. The low voltage current from the transformers is carried by bus, through bus duct, into a building housing the metal-clad switchgear with air circuit breakers rated 5000v, 1200 amp, buswork potential and current transformers for instrumentation, and control power transformers.

Station B, rated at 750 kva, and station C, rated at 3000 kva, receive their current direct from the switching point.

Contractor for the installation was Manning-Whitaker of San Francisco. The substations and auxiliary equipment were supplied by the General Electric Co.

Slime Control IN COOLING SYSTEMS



Chlorination — the modern way to prevent slime buildup in condensers and heat exchangers — saves you money if it's right. But if dosage is too heavy, you run the risk of corrosion . . . or if it's too light, chlorination is worthless.

Builders Chlorinizer is the key to safe, effective, economical chlorination in cooling systems. CHLORINIZER IS ACCURATE . . . The sensitive compensating valve and the visible-flow Sightflo Indicator guarantee correct feed for effective treatment and insure against corrosion. CHLORINIZER IS SAFE . . . The full vacuum principle automatically and positively shuts off chlorine feed on loss of vacuum. CHLORINIZER IS SIMPLE . . . Because of its basic design, Chlorinizer is readily adaptable to single or multiple point applications on manual, semi-automatic, or fully automatic control.

Builders Chlorinizers are available in three volumetric models for feeding from a few pounds to 6,000 pounds per day. Send coupon for complete details.

BUILDERS-PROVIDENCE, INC.

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Please send Application Memo No. 840-J9 describing Chlorinizer slime control system.

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overhead

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Anywhere!

Ric-wiL units can be jacked through tunnels, under streets or railroad tracks without interrupting traffic.

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Nov. 29-Dec. 4	American Society of Mechanical Engineers (Annual Meeting)	Statler Hotel New York, N.Y.
Nov. 30-Dec. 5	Chemical Industries Exposition	Commercial Museum Philadelphia, Pa.
Dec. 8-10	Joint Computer Conference and Show	Statler Hotel Washington, D.C.
Dec. 12-15	American Institute of Chemical Engineers (Annual Meeting)	Statler Hotel New York, N.Y.
Dec. 13-16	American Institute of Chemical Engineers (Annual Meeting)	Jefferson Hotel St. Louis, Mo.
Jan. 18-22	American Institute of Electrical Engineers (Winter Gen'l Meeting)	Statler Hotel New York, N.Y.
Jan. 25-28	Plant Maintenance and Engineering Conference	Conrad Hilton Hotel Chicago, Ill.

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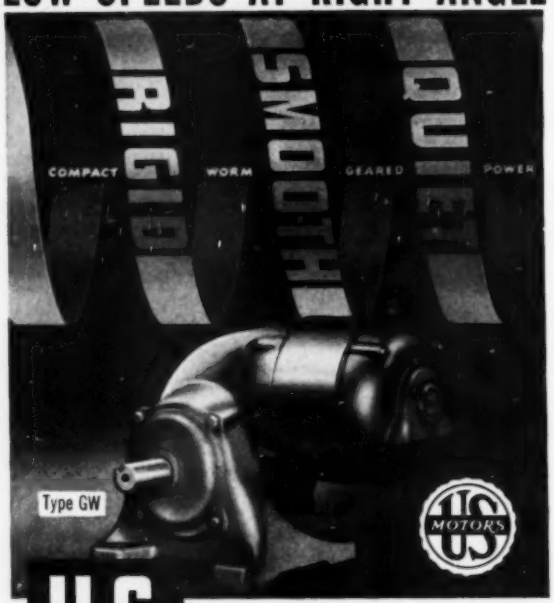

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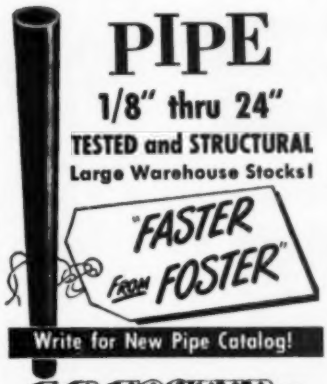
1/8" thru 24"
TESTED and STRUCTURAL
Large Warehouse Stocks!



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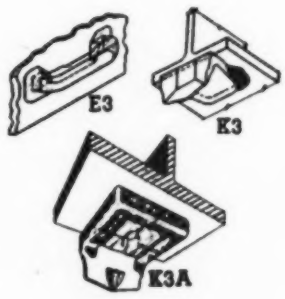

Saxe Erection Units position and secure structural parts for welding.

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Use of these units eliminates all hole punching and produces the most economical, safe, and quickly erected structural frame.

Write for **"Structural Welding Practice"** manual, containing full engineering design information.

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"Hidden Losses From Electrical Systems," May 1953

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"Application of Spreader Stokers," Mar. 1953

"Dirty Water Gets The Treatment," Aug. 1953

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"Interpreting Stack Losses," Aug. 1953

"Axial Flow Pumps . . . Their Characteristics," July 1952

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"Feedwater Heating Calculations For Steam Turbines," May 1953

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DRY TYPE
TRANSFORMERS
PROFITABLY
IN YOUR PLANT

Planning the electrical system of your plant with Acme Electric dry type transformers can save you money, material and time. How to eliminate double wiring, provide 3-wire secondary circuits, insulate circuits or balance voltage are only a few of the many ways you can use Acme Electric dry type transformers. Write for the folder DT 195 containing ideas and wiring diagrams. Acme Electric transformers are available in single phase sizes from 1/10 thru 500 KVA; three phase from 3 thru 750 KVA.

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Patch broken concrete floors without tying up plant traffic. Use durable INSTANT-USE — a tough plastic material which takes traffic immediately. Ideal for repairing cracks, holes, ruts. Bonds tight to old concrete . . . right up to feather edge.

JUST TAMP! TRUCK OVER!

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advertisers' index

Acme Electric Corp. 134
Aerotec Corp. 25
Airetool Manufacturing Co. 38
American Engineering Co. 65
American Water Softener Co. •
Ames Iron Works 117
Anderson Co., The V. D. •
Armstrong Machine Works Second Cover
Atlantic Metal Hose Co. 128
Aurora Pump Co. •

Babcock & Wilcox Co., The •
Beaumont-Birch Co. •
Bell & Zoller Coal Co. 64
Betz, W. H. & L. D. 17
Bird-Archer Co., The 123
Bituminous Coal Institute 14-15
Blaw-Knox Co. •
Boiler Engineering & Supply Co. •
Buell Engineering Co., Inc. •
Builders-Providence, Inc. 131
Bussmann Mfg. Co. 30-31
Byers Co., A. M. •

Cambridge Instrument Co., Inc. •
Chapman Valve Mfg. Co., The 44
Chicago Pneumatic Tool Co. 46
Cleaver-Brooks Co. 37
Clipper Mfg. Co. •
Cochrane Corp. 55
Combustion Engineering, Inc. •
Cook's Sons, Inc., Adam •
Cooper-Bessemer Corp., The •
Coppus Engineering Corp. 39
Crane Co. 7
Crane Packing Co. 112
Cuno Engineering Corp. •
Cyclotherm Div., U. S. Radiator Corp. 106

Darling Valve & Mfg. Co. 52
Dart Union Co. •
Davis Regulator Co. •
Dearborn Chemical Co. •
DeLaval Steam Turbine Co. •
Detroit Stoker Co. 4
Diamond Power Specialty Corp. 63
Dutton Boiler Div., Hapman-Dutton Co. •
Dynamatic Corp. •

Eastern Gas & Fuel Associates •
Economy Fuse and Mfg. Co. 58
Edward Valves Inc., Subsidiary of Rockwell Mfg. Co. 108-109
Electric Auto-Lite Co., The •
Elgin-Refinite, Inc., Div. of Elgin Softener Corp. 35
Elliott Co., Lagonda Div. 122
Elliott Co., The 22-23
Engineer Co., The 110
Erie City Iron Works 53
Everlasting Valve Co. •

Felt Products Mfg. Co. 117
Fiske Bros. Refining Co. •
Flexonics Corp., Chicago Metal Hose Div. •
Flexrock Co., The 134
Foster Wheeler Corp. 33

Gates Rubber Co., The •
General Coal Co. •
General Electric Co. 29, 47
General Motors Corp., Hyatt Bearings Div. 111
Gifford-Wood Co. •
Goodyear Tire & Rubber Co., The •
Graver Water Conditioning Co. 98
Grinnell Co., Inc. 45

Hartzell Propeller Fan Co. •
Hays Corp., The 41
Heacon, Inc. 43
Heinemann Electric Co. 24
Henszey Co. 119
Hilliard Corp., The •
Hills-McCanna Co. •
Hoffman Specialty Mfg. Corp. •
Hungerford & Terry, Inc. 127
Hyatt Bearings Div., General Motors Corp. 111

Ideal Industries, Inc. •
Illinois Engineering Co., Inc. •
Infilco Inc. •
Ingersoll-Rand Co. 57
International Nickel Co., Inc., The •
I-T-E Circuit Breaker Co. 18-19

Jenkins Bros. 9
Jerguson Gage & Valve Co. •
Johns-Manville Corp. 54
Johnston & Jennings Co., The •
Johnston Pump Co. •

Kano Laboratories •
Kewanee-Ross Corp. •
Key Co., The •
Kirk & Blum Mfg. Co., The 103

La Favorite Rubber Mfg. Co., Inc. •
Leslie Co. 27
Link-Belt Co. 3
Liquidometer Corp., The 127
Lovejoy Flexible Coupling Co. 118

Manhattan Rubber Div. •
Manzel, Inc. •
Marietta Concrete Corp., The •
Mercoid Corp., The •
Milton Roy Co. 21
Murray Iron Works Co. •
Murray Mfg. Co., D. J. •

National Aluminate Corp. 13
National Conveyors Co., Inc. •
New York & New Jersey Lubricant Co. 128
Niagara Blower Co. 40
Nicholson & Co., W. H. 130
Norgren Co., C. A. 126
Northern Blower Co., The 125

Orchem Pump Div. •
Orr & Sembower, Inc. 61

Patterson-Kelley Co., Inc., The •
Petro Div. •
Pick Manufacturing Co. 104
Prat-Daniel Corp. 107
Preferred Utilities Mfg. Corp. •
Proto Tools 6
Powers Regulator Co., The 127
%Proportioneers, Inc.% 51

Raybestos-Manhattan, Inc. 62
Refractory & Insulation Corp. 121
Research Corp. 56
Ric-wiL Co. 132
Riley Stoker Corp. •
Rockwell Co., W. S. 129
Rockwell Mfg. Co., Edward Valves, Inc., Sub. 108-109
Rohm & Haas Co., Resinous Products Div., The •
Rust-Oleum Corp. •

Sarco Co., Inc. Third Cover
Schramm, Inc. 34
Shell Oil Co. 105
Sims Pump Valve Co., Inc. 127
Sinclair Refining Co. 59
Smooth-On Mfg. Co. 117
Snap-On Tools Corp. 28
Sorensen & Co., Inc. 124
Spence Engineering Co., The 50
Standard Oil Co. (Indiana) 49
Standard Pressed Steel Co. •
Strong, Carlisle and Hammond Co. 116
Superior Combustion Industries, Inc. 114
Sun Oil Co. •
Sweet's Catalog Service 129

Terry Steam Turbine Co., The •
Texas Co., The Fourth Cover
Thermix Corp., The 43, 25
Trane Co. 26

United States Gasket Co. 120
Universal Atlas Cement Co. 48
U. S. Electrical Motors, Inc. 132
U. S. Hoffman Machinery Corp. 115
U. S. Radiator Corp., Cyclotherm Div. 106

Vogt Machine Co., Henry 60

Weinman Pump Mfg. Co., The •
Western Precipitation Corp. 113
Weston Electrical Instrument Corp. •
Wickes Boiler Co. 101
Wiegand Co., Edwin L. •
Wilson Inc., Thomas C. •
Wing Mfg. Co., L. J. 32
Worthington Corp., Centrifugal Pump Div. 96
Compressor Div. 10
Steam-Turbine Div. 11
Wright-Austin Co. 42

Yarnall-Waring Co. 66

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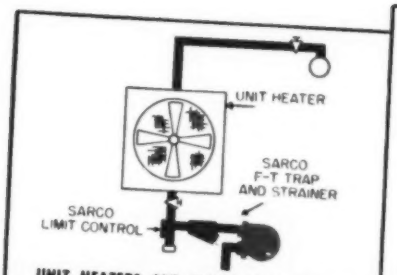
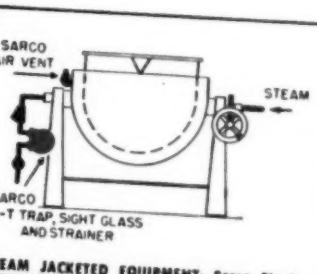
Is this your TRAPPING PROBLEM?

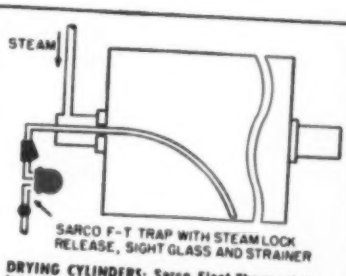
How to get:
maximum heat transfer over entire heating surface under varying condensate loads and steam pressures



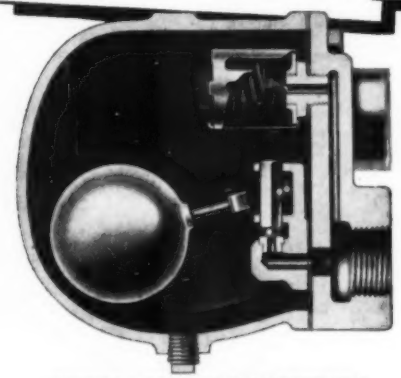
UNIT HEATERS AND BLAST COILS: Air and gases which insulate the heating surface are automatically vented by the Sarco Float-Thermostatic trap. Condensate is discharged continuously.



STEAM JACKETED EQUIPMENT: Sarco Float-Thermostatic trap removes condensate as it collects; vents air regardless of steam pressure. Separate air vent eliminates air trapped in upper part of jacket.



DRYING CYLINDERS: Sarco Float-Thermostatic trap is equally efficient with heavy or light loads. Trap is equipped with a device to prevent steam locking in the syphon pipe of the cylinder.



SARCO FLOAT-THERMOSTATIC STEAM TRAP

Sizes ¾" to 2½". For complete specifications send for Bulletin 450.

How to select the right trap

There is no universal steam trap. For efficient trapping always match the characteristics of the trap to the requirements of the job.

The characteristics of the Sarco Float-Thermostatic trap, for example, are:

1. Discharges condensate continuously at steam temperature.
2. Responds immediately to varying loads and pressures.
3. Automatically vents air on start-up and during operation.
4. Does not cause pressure pulsations which disturb temperature control.

Whatever your trapping needs may be, there's one type trap that will do the job better than any other. Only Sarco makes *all* types – you can always choose a Sarco trap best suited to your job.

HELPFUL BULLETIN: "Selecting the Right TYPE Steam Trap" can help you. It gives characteristics of each type of trap and shows which type to use on various installations. Send for Bulletin 145.

ENGINEERING SERVICE: You can obtain impartial advice on your trapping problems from Sarco Engineers. Sarco makes *all types* of steam traps – favors no one type. Whenever you need help, call your local Sarco representative.

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REMEMBER—only Sarco makes all types

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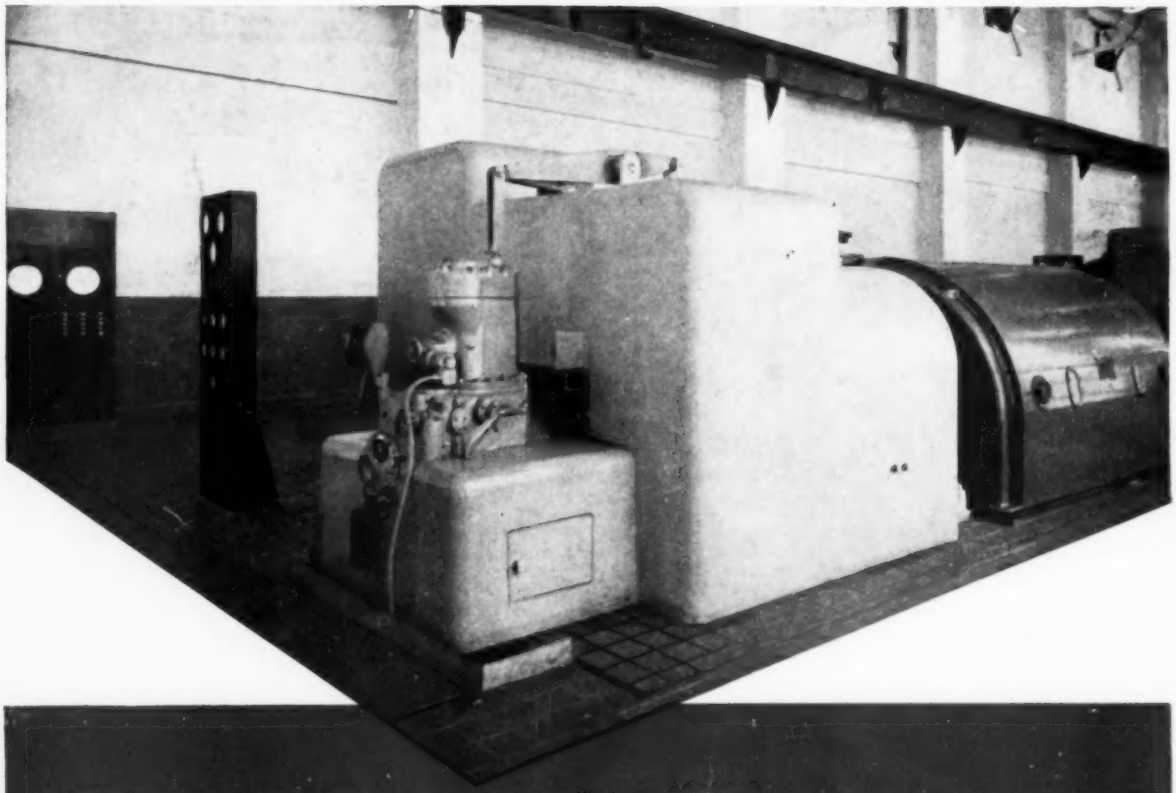

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